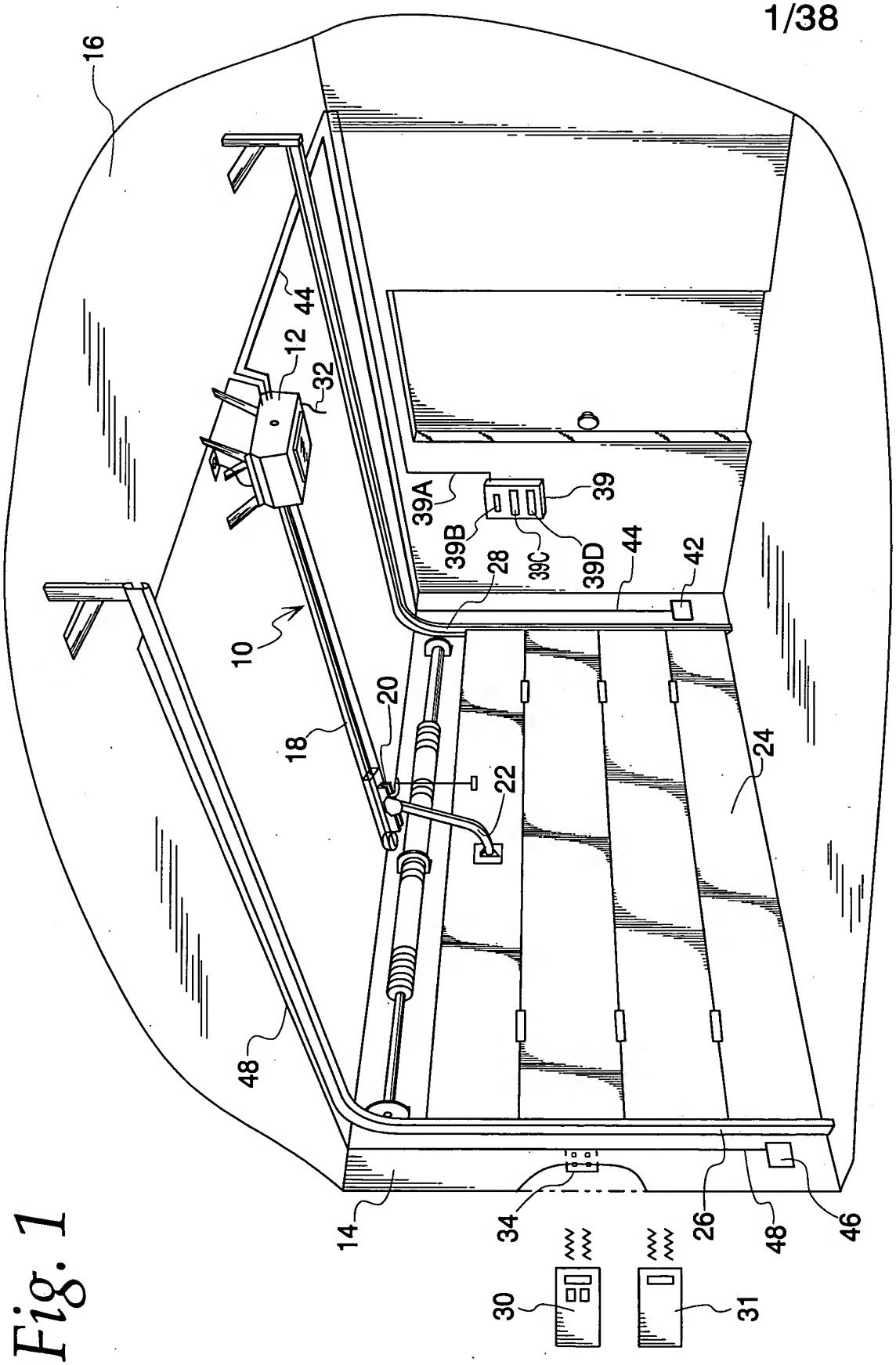

16
44
12
32
39A
39B
39C
39D
39
28
44
42
10
20
18
22
24
48
14
34
26
48
46
30
31

Fig. 1

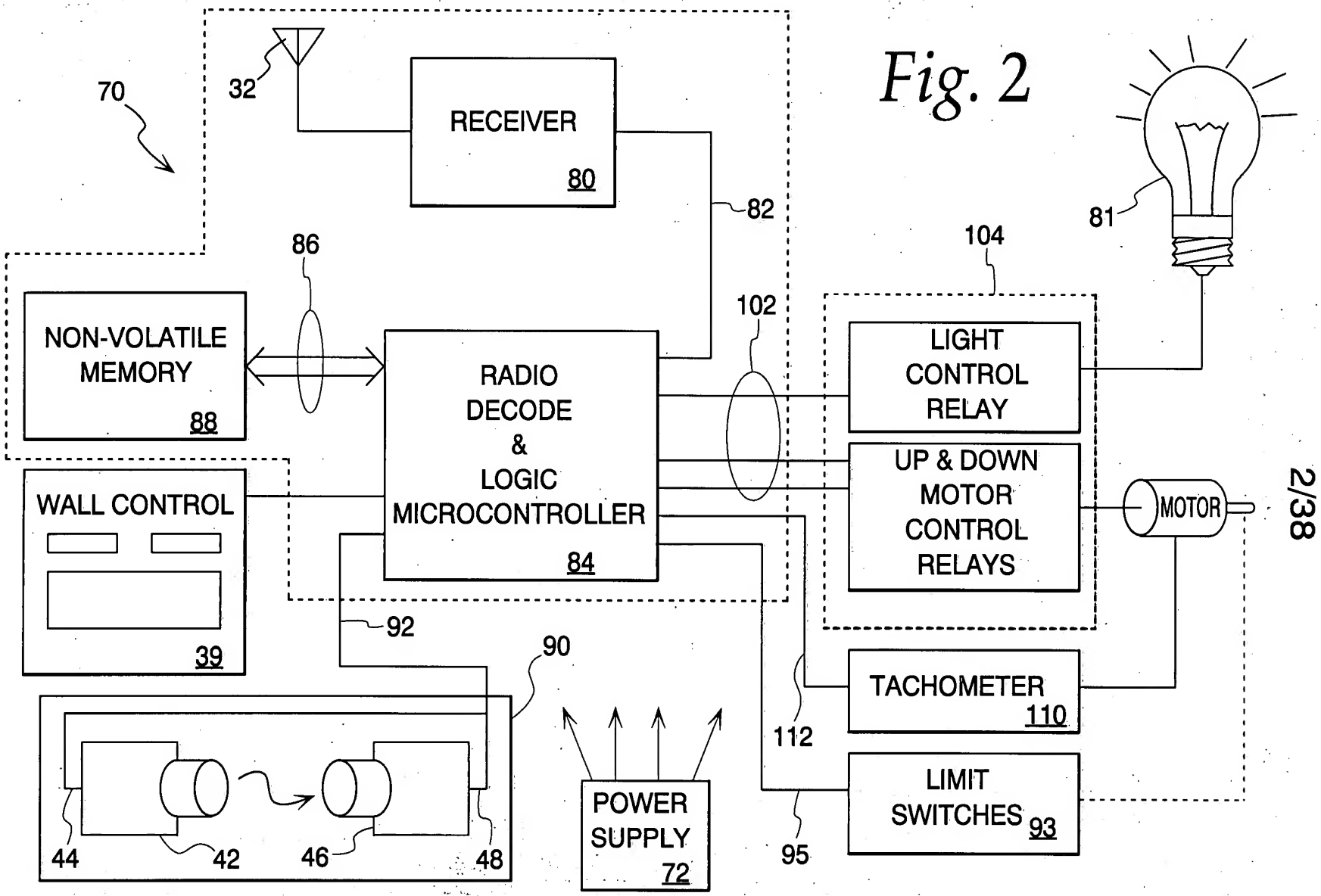

70
32
RECEIVER
80
82
86
NON-VOLATILE MEMORY
88
RADIO DECODE & LOGIC MICROCONTROLLER
84
102
104
LIGHT CONTROL RELAY
UP & DOWN MOTOR CONTROL RELAYS
81
MOTOR
WALL CONTROL
39
92
90
TACHOMETER
110
112
LIMIT SWITCHES
93
95
POWER SUPPLY
72
44
42
46
48

Fig. 2

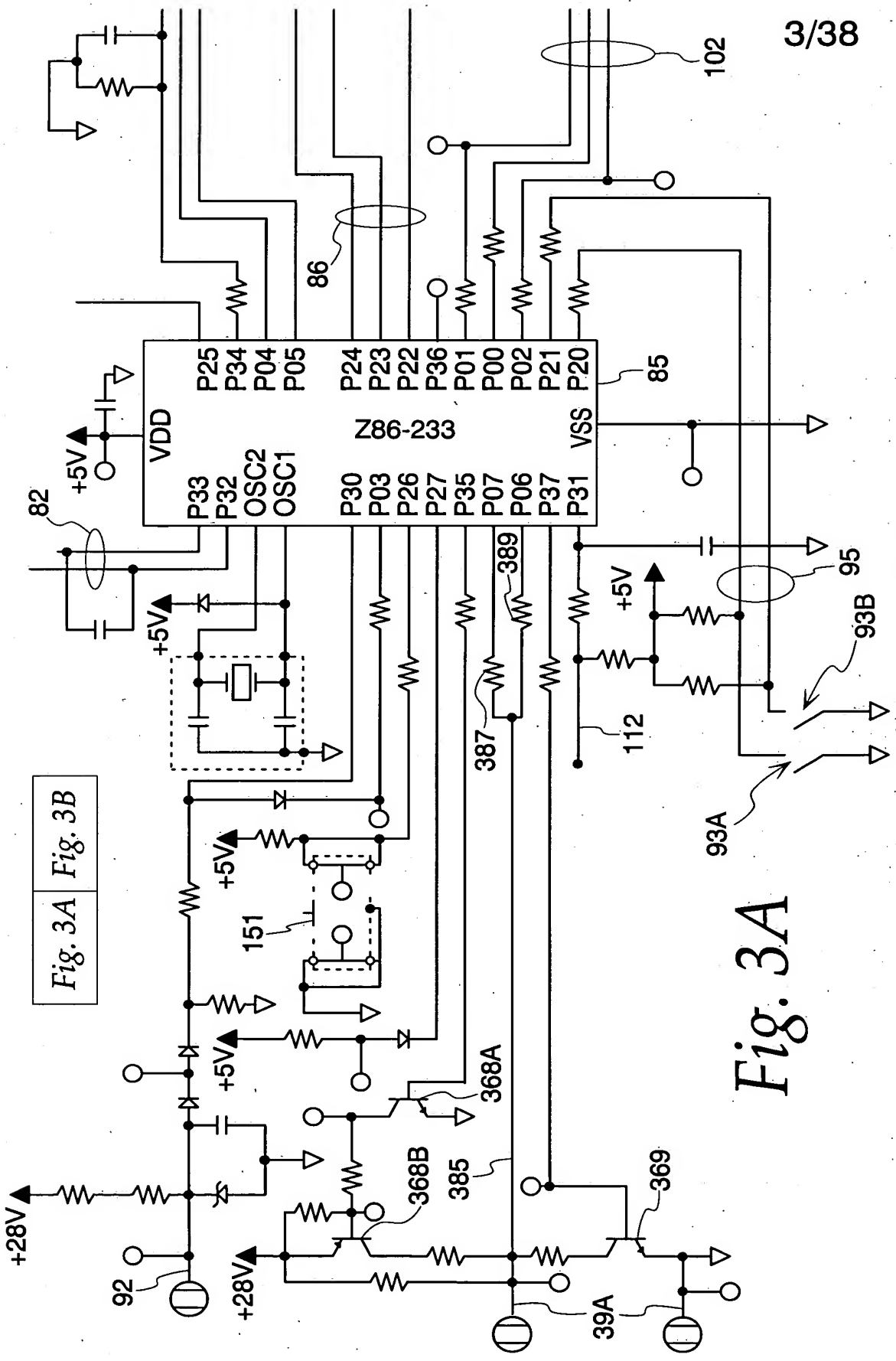


Fig. 3A

Fig. 3A	Fig. 3B

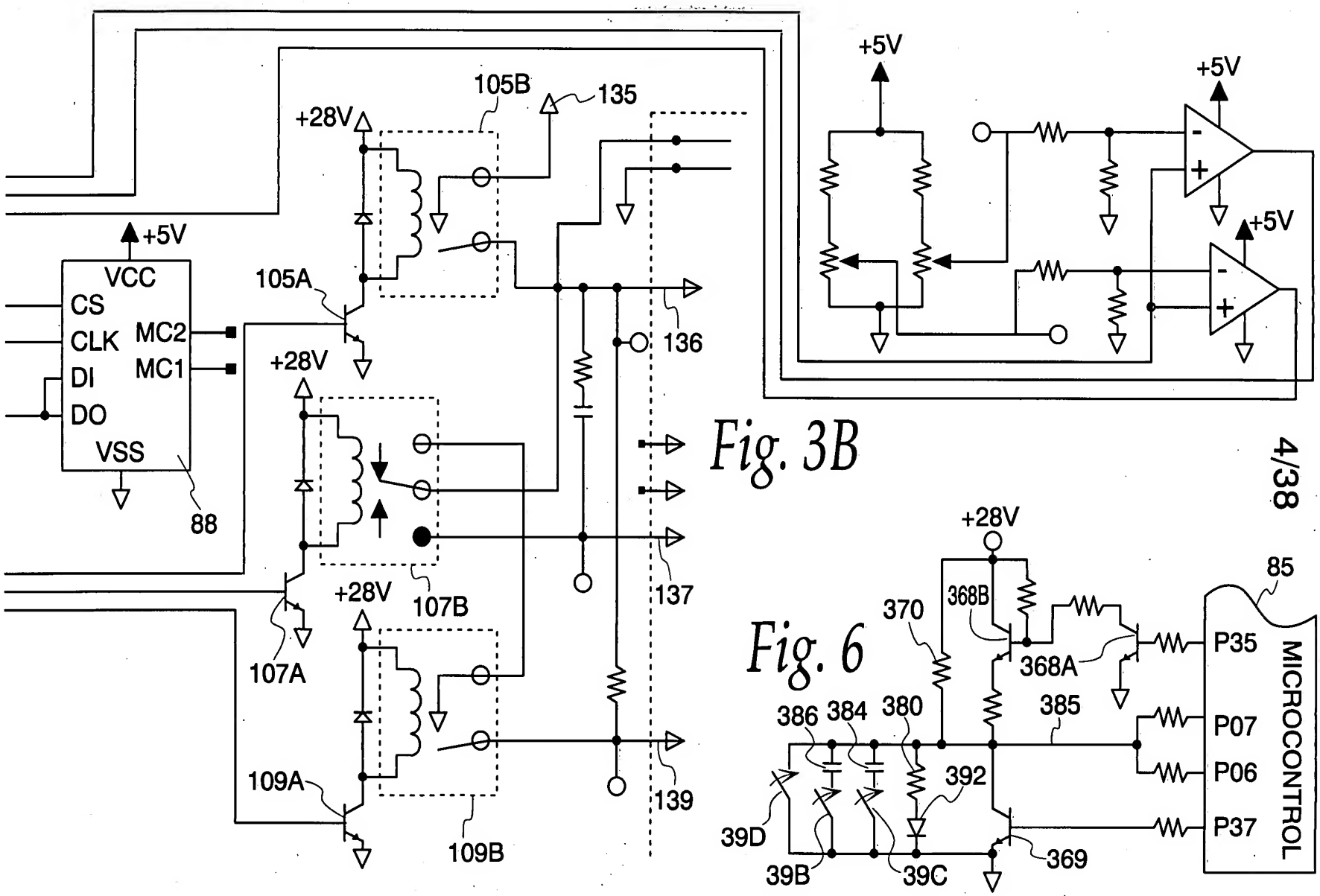

+5V
VCC
CS
CLK
DI
DO
VSS
MC2
MC1
88
105B
135
+28V
105A
136
107B
107A
137
109A
109B
139
+5V
+5V
+5V

Fig. 3B

+28V
85
370
368B
368A
386
384
380
385
392
39D
39B
39C
369
P35
P07
P06
P37
MICROCONTROL

Fig. 6

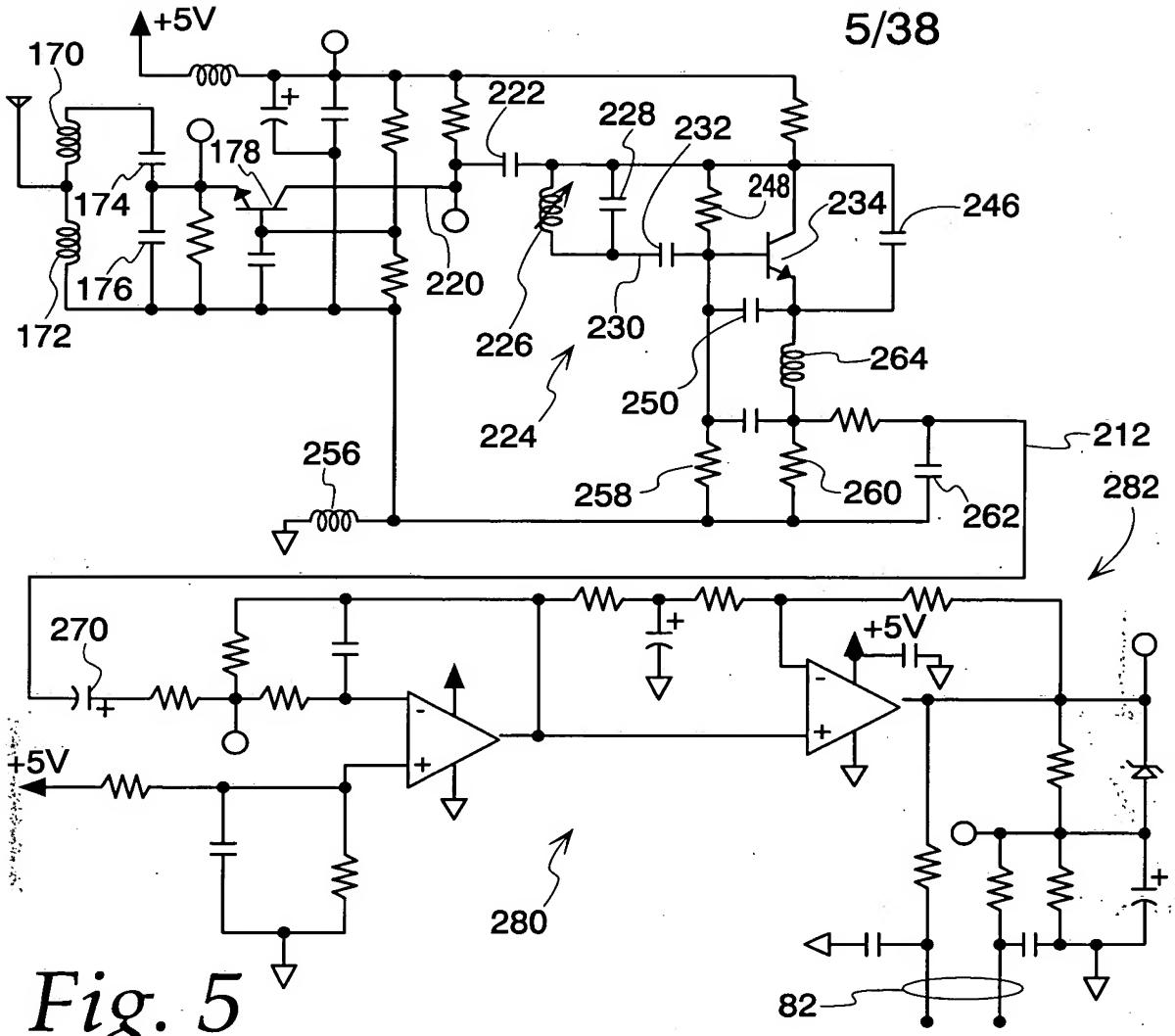

+5V
170
178
174
176
172
222
228
232
248
234
246
220
226
230
224
250
264
256
212
258
260
262
282
270
+5V
+5V
280
82

Fig. 5

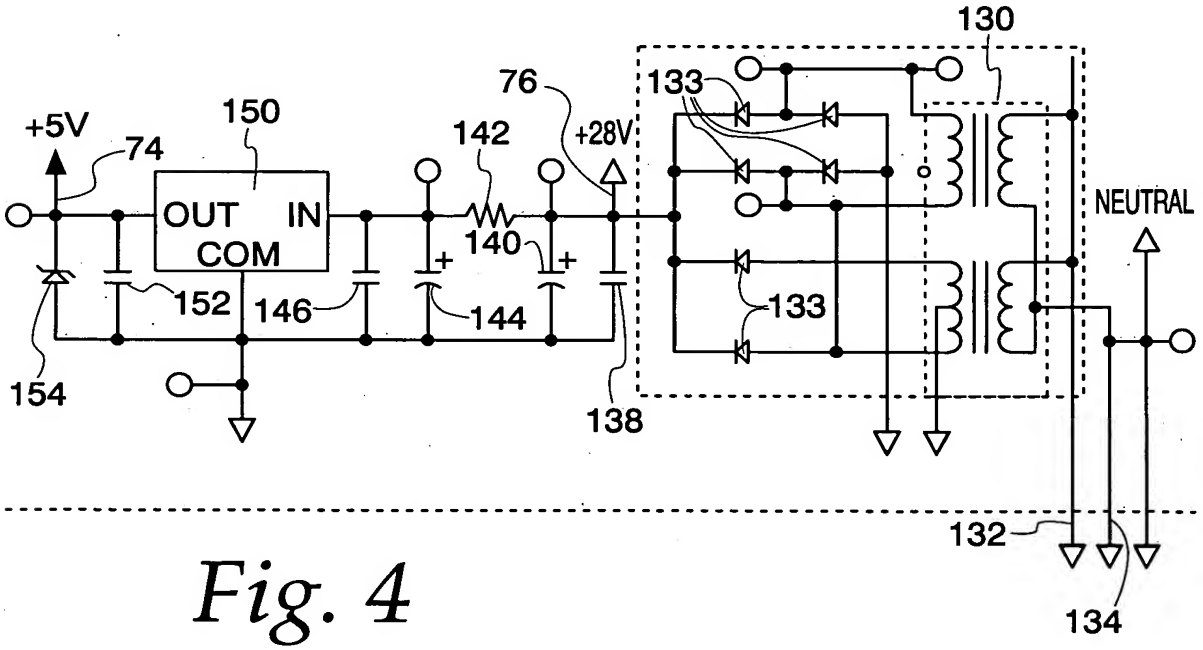

130
76
133
+5V
150
74
142
+28V
OUT
IN
COM
140
152
146
144
133
NEUTRAL
154
138
132
134

Fig. 4

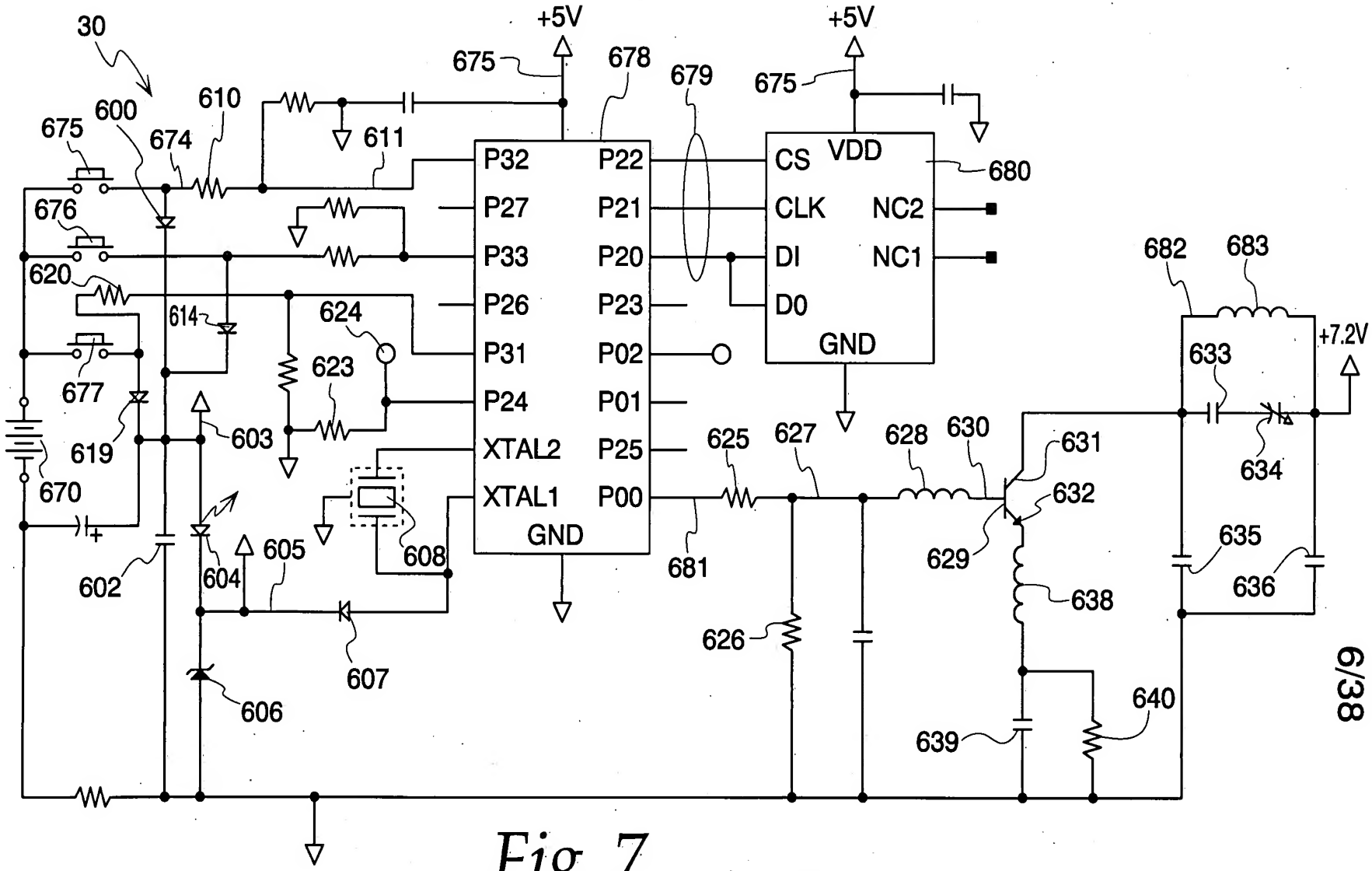

30
+5V
675
678
679
610
600
611
674
676
620
614
624
623
677
619
603
670
625
627
628
630
631
632
629
634
633
682
683
+7.2V
P32
P22
P27
P21
P33
P20
P26
P23
P31
P02
P24
P01
XTAL2
P25
XTAL1
P00
GND
CS
VDD
CLK
NC2
DI
NC1
D0
GND
680
602
604
605
608
681
638
635
636
626
607
606
639
640

Fig. 7

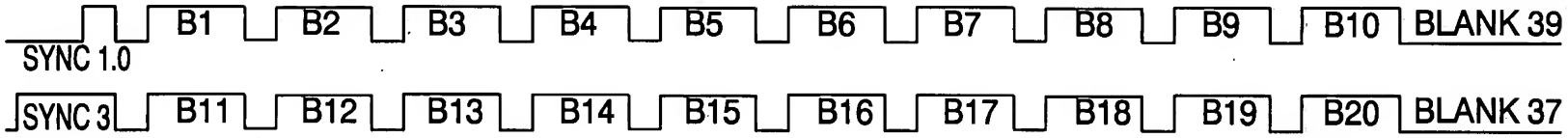


Fig. 13

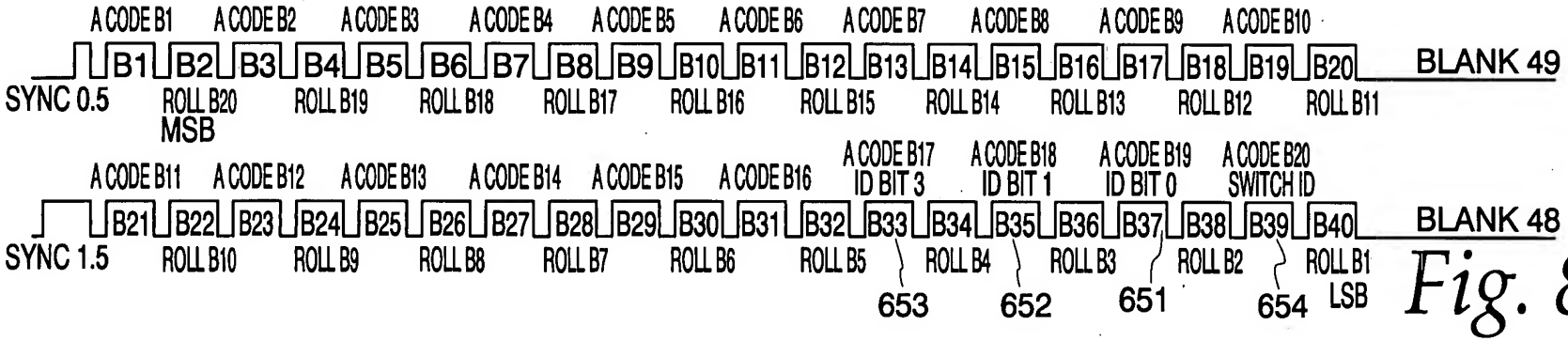


Fig. 8

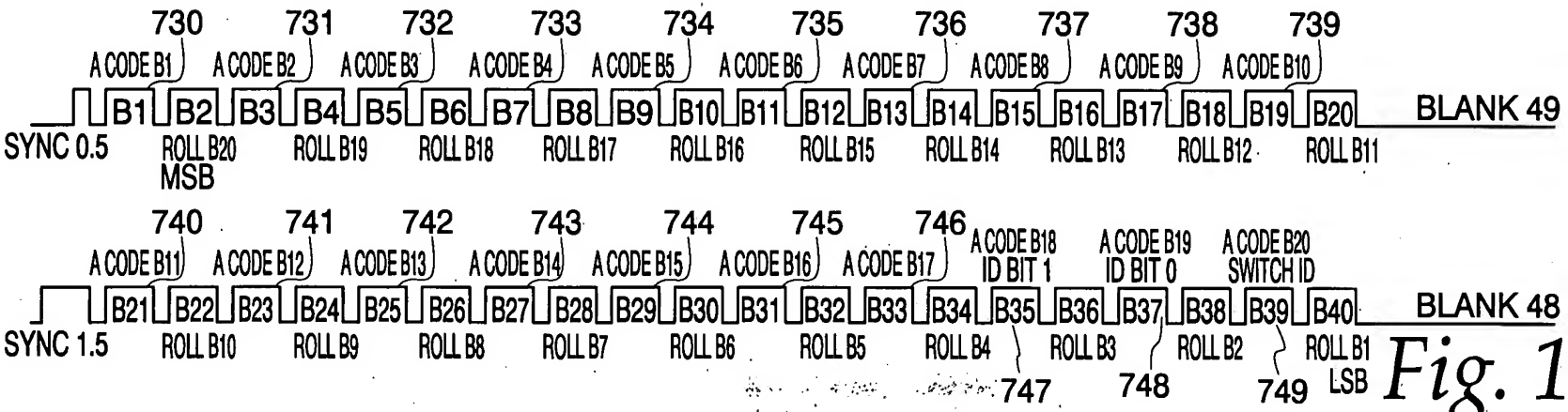


Fig. 11

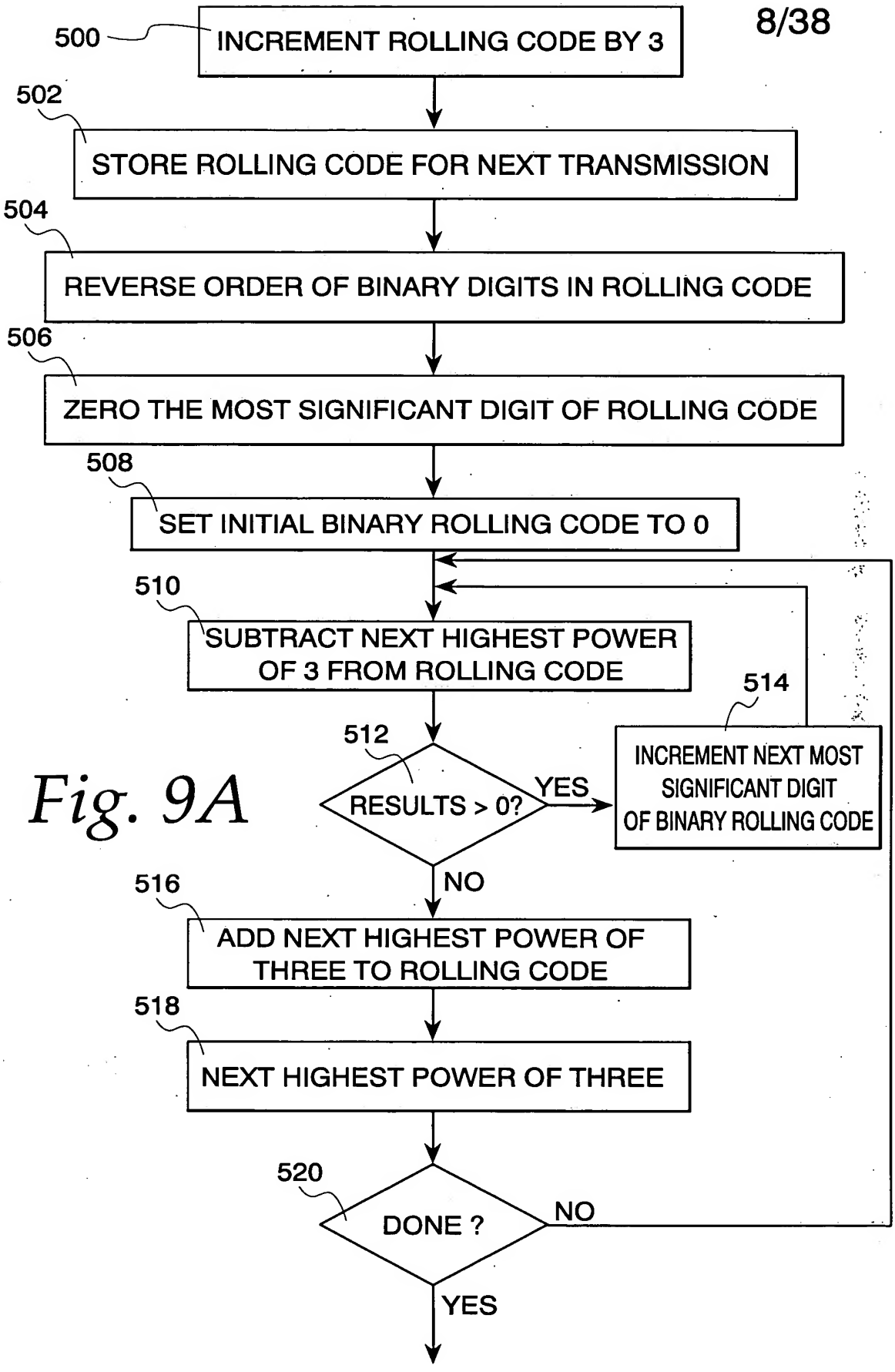

500
INCREMENT ROLLING CODE BY 3
502
STORE ROLLING CODE FOR NEXT TRANSMISSION
504
REVERSE ORDER OF BINARY DIGITS IN ROLLING CODE
506
ZERO THE MOST SIGNIFICANT DIGIT OF ROLLING CODE
508
SET INITIAL BINARY ROLLING CODE TO 0
510
SUBTRACT NEXT HIGHEST POWER OF 3 FROM ROLLING CODE
512
RESULTS > 0?
YES
514
INCREMENT NEXT MOST SIGNIFICANT DIGIT OF BINARY ROLLING CODE
NO
516
ADD NEXT HIGHEST POWER OF THREE TO ROLLING CODE
518
NEXT HIGHEST POWER OF THREE
520
DONE ?
NO
YES

Fig. 9A

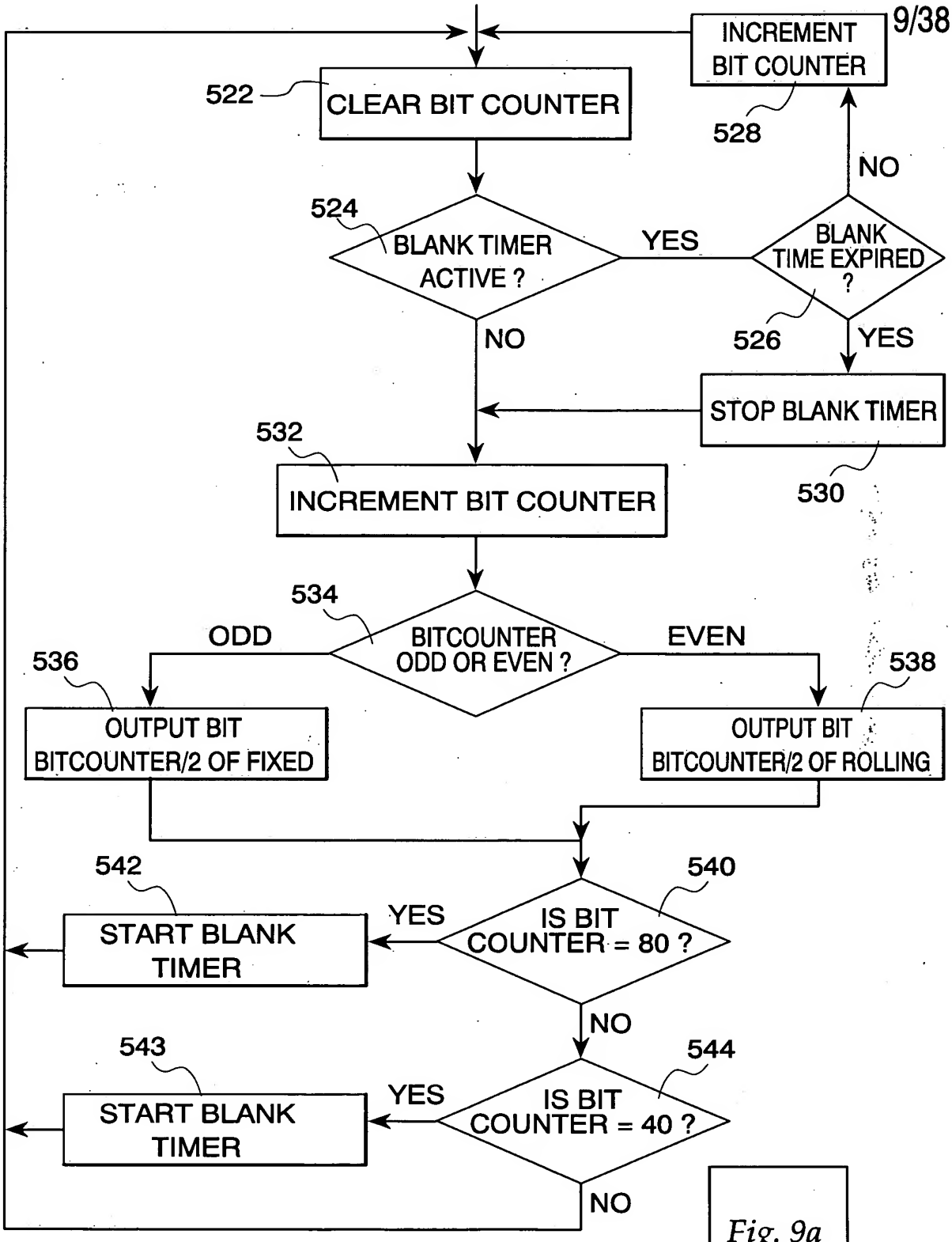


Fig. 9B

Fig. 9a

Fig. 9b

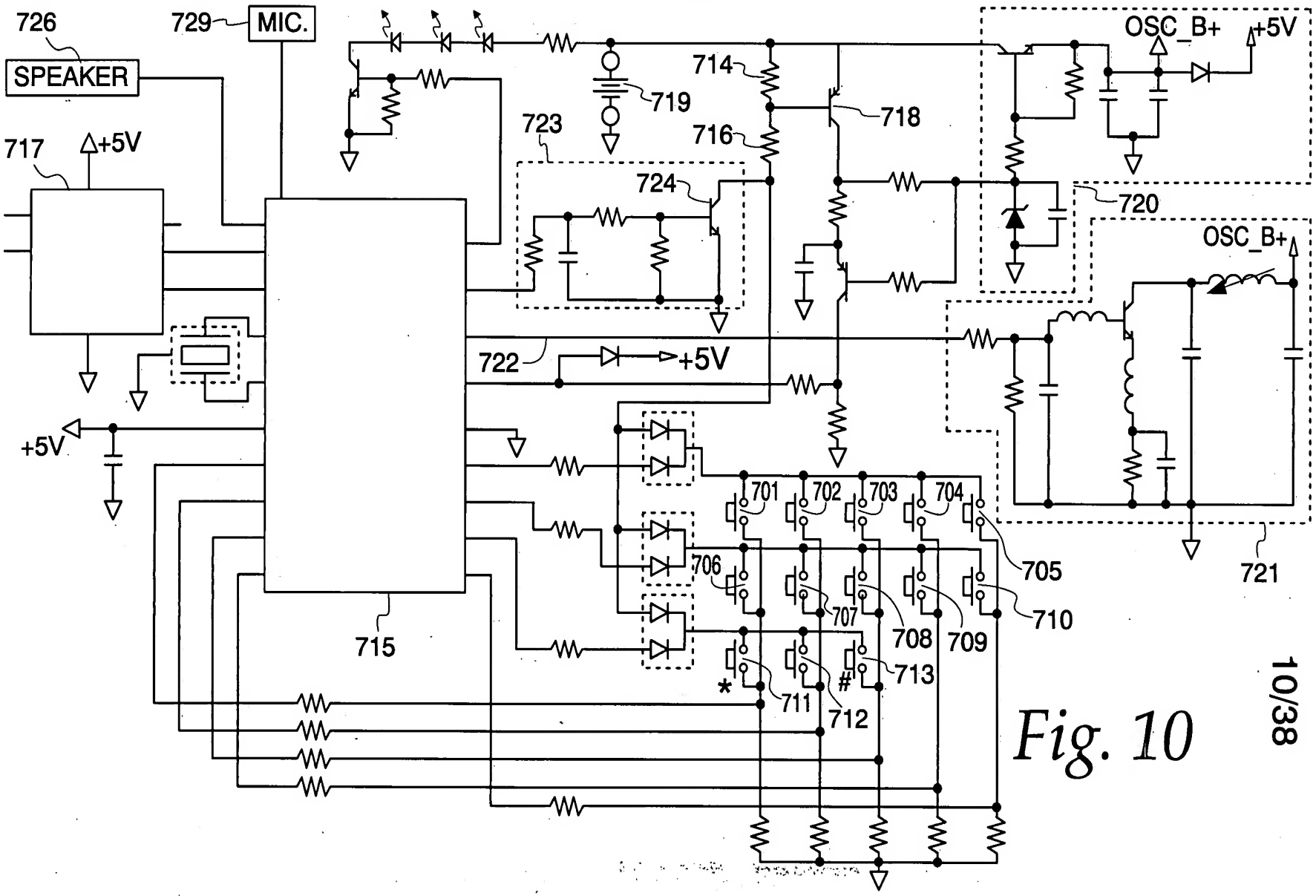

726
SPEAKER
729
MIC.
717
+5V
719
714
718
723
716
724
OSC_B+
+5V
720
OSC_B+
722
+5V
+5V
701
702
703
704
705
706
707
708
709
710
711
712
713
715
721

Fig. 10

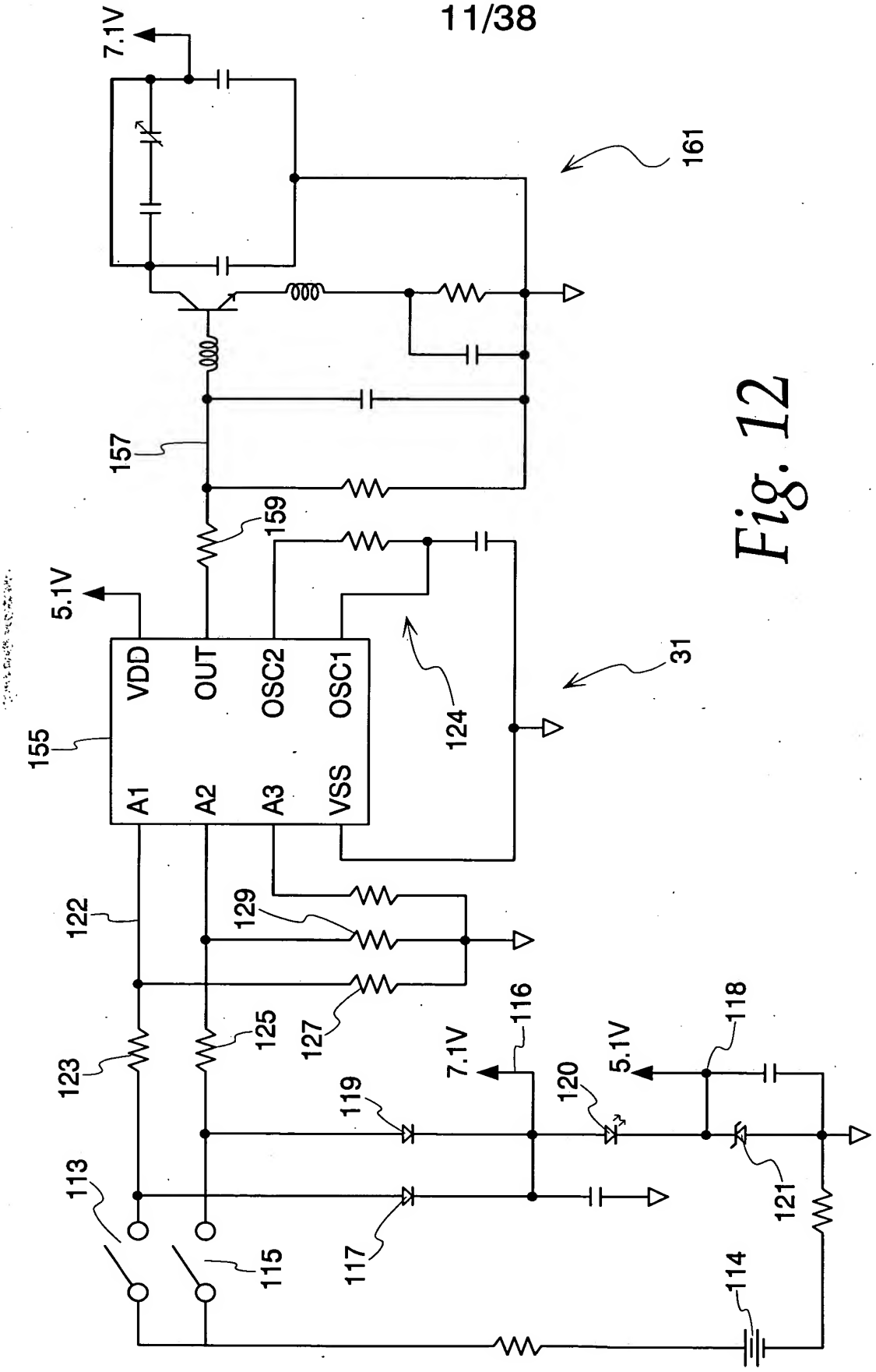
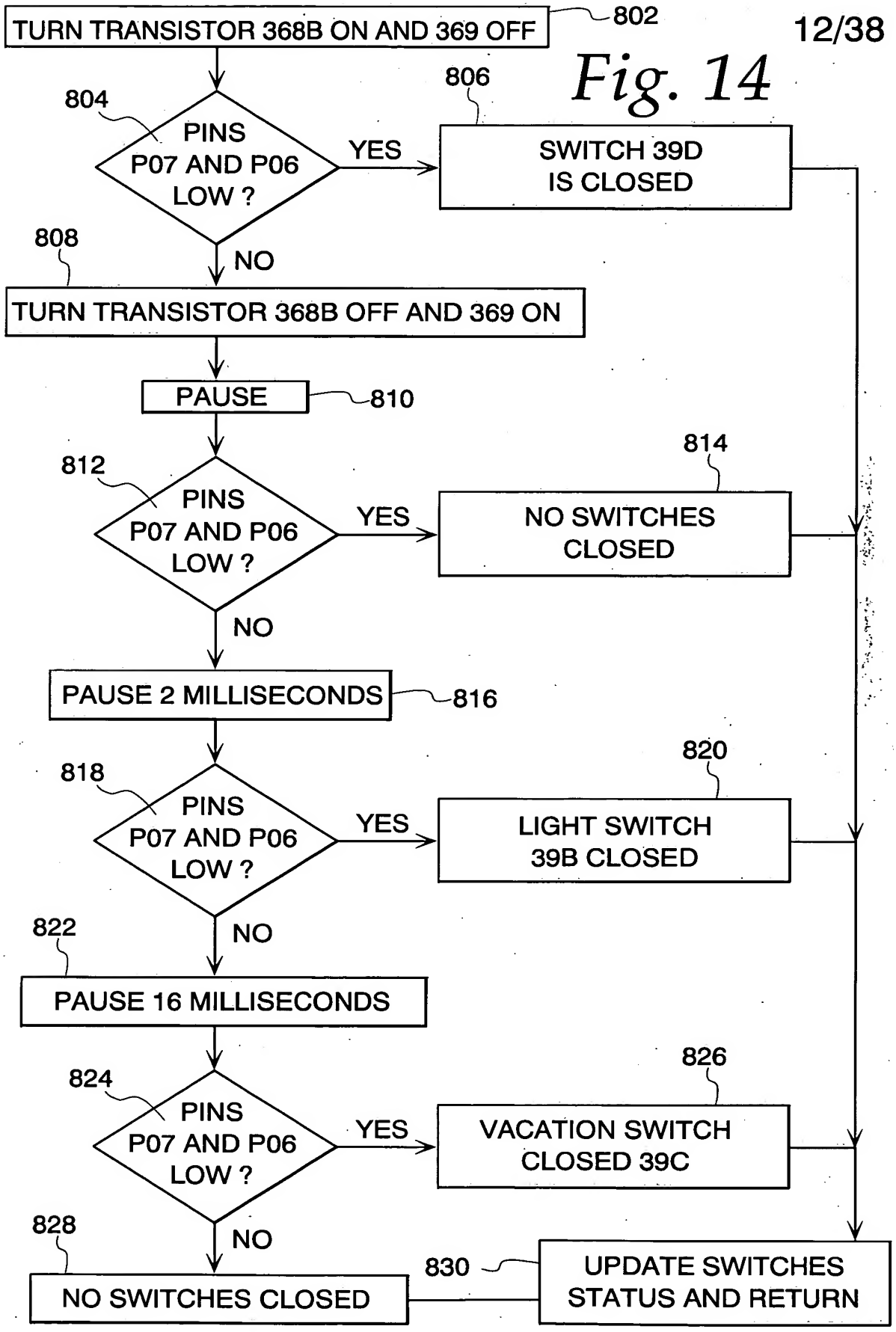

7.1V
161
157
159
5.1V
VDD
OUT
OSC2
OSC1
155
A1
A2
A3
VSS
124
31
122
129
123
125
127
7.1V
116
5.1V
118
119
120
113
115
117
121
114

Fig. 12

Fig. 14


TURN TRANSISTOR 368B ON AND 369 OFF
802
804
PINS P07 AND P06 LOW ?
YES
806
SWITCH 39D IS CLOSED
NO
808
TURN TRANSISTOR 368B OFF AND 369 ON
PAUSE
810
812
PINS P07 AND P06 LOW ?
YES
814
NO SWITCHES CLOSED
NO
PAUSE 2 MILLISECONDS
816
818
PINS P07 AND P06 LOW ?
YES
820
LIGHT SWITCH 39B CLOSED
NO
822
PAUSE 16 MILLISECONDS
824
PINS P07 AND P06 LOW ?
YES
826
VACATION SWITCH CLOSED 39C
NO
828
NO SWITCHES CLOSED
830
UPDATE SWITCHES STATUS AND RETURN

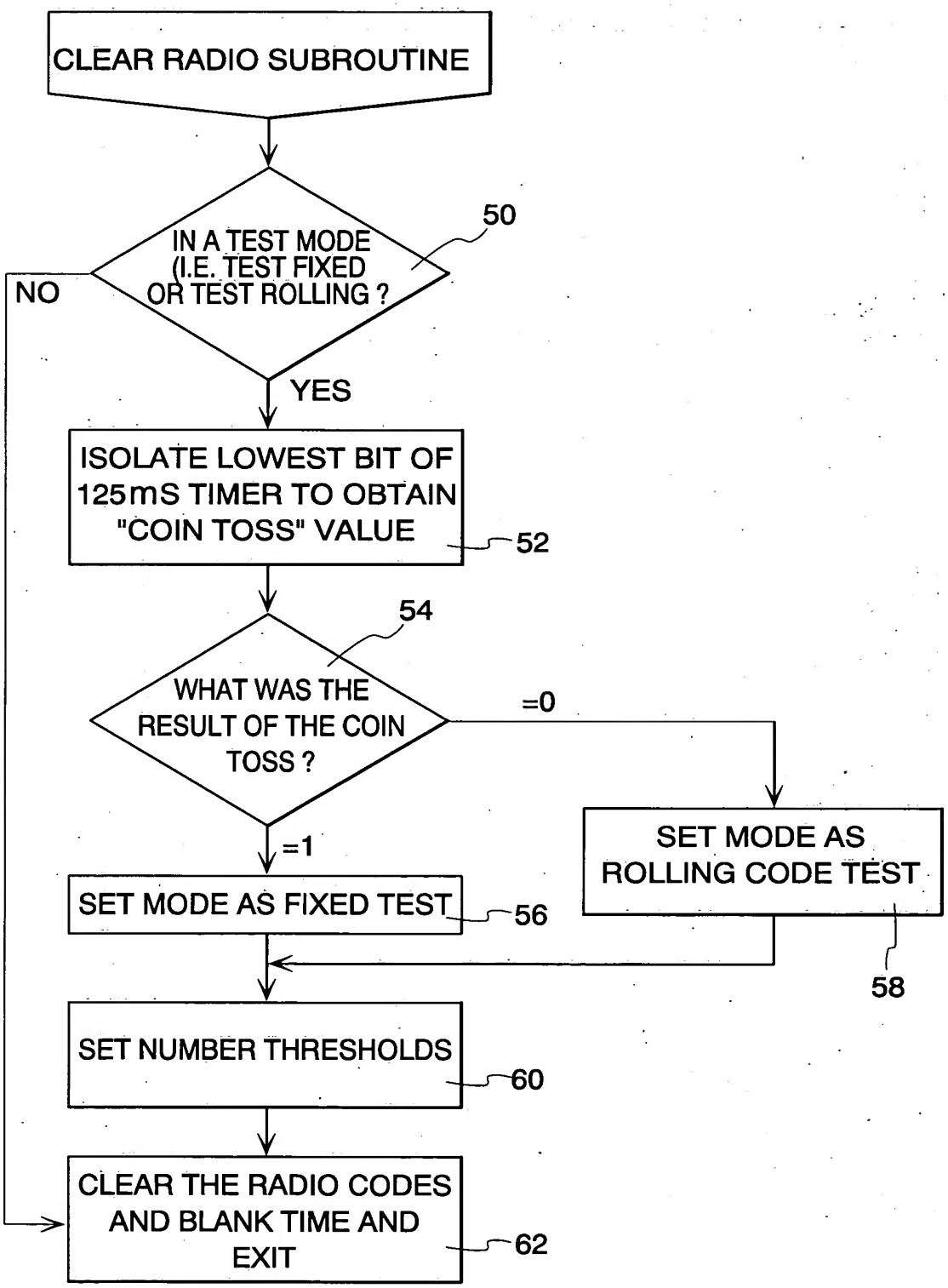

CLEAR RADIO SUBROUTINE
IN A TEST MODE (I.E. TEST FIXED OR TEST ROLLING ?
50
NO
YES
ISOLATE LOWEST BIT OF 125mS TIMER TO OBTAIN "COIN TOSS" VALUE
52
54
WHAT WAS THE RESULT OF THE COIN TOSS ?
=0
=1
SET MODE AS ROLLING CODE TEST
SET MODE AS FIXED TEST
56
58
SET NUMBER THRESHOLDS
60
CLEAR THE RADIO CODES AND BLANK TIME AND EXIT
62

Fig. 15

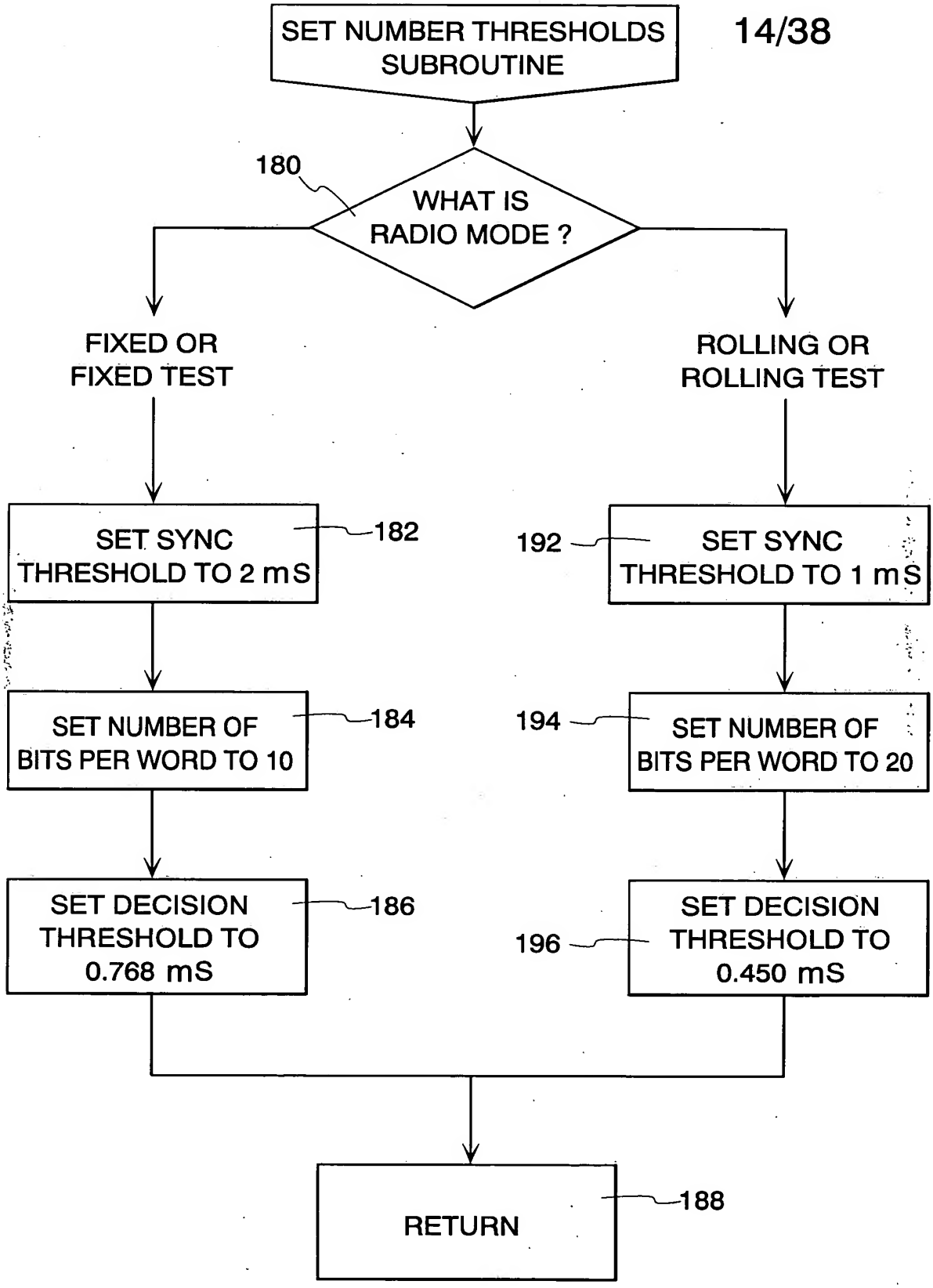

SET NUMBER THRESHOLDS SUBROUTINE
180
WHAT IS RADIO MODE ?
FIXED OR FIXED TEST
ROLLING OR ROLLING TEST
SET SYNC THRESHOLD TO 2 mS
182
SET NUMBER OF BITS PER WORD TO 10
184
SET DECISION THRESHOLD TO 0.768 mS
186
192
SET SYNC THRESHOLD TO 1 mS
194
SET NUMBER OF BITS PER WORD TO 20
196
SET DECISION THRESHOLD TO 0.450 mS
RETURN
188

Fig. 16

Fig. 17

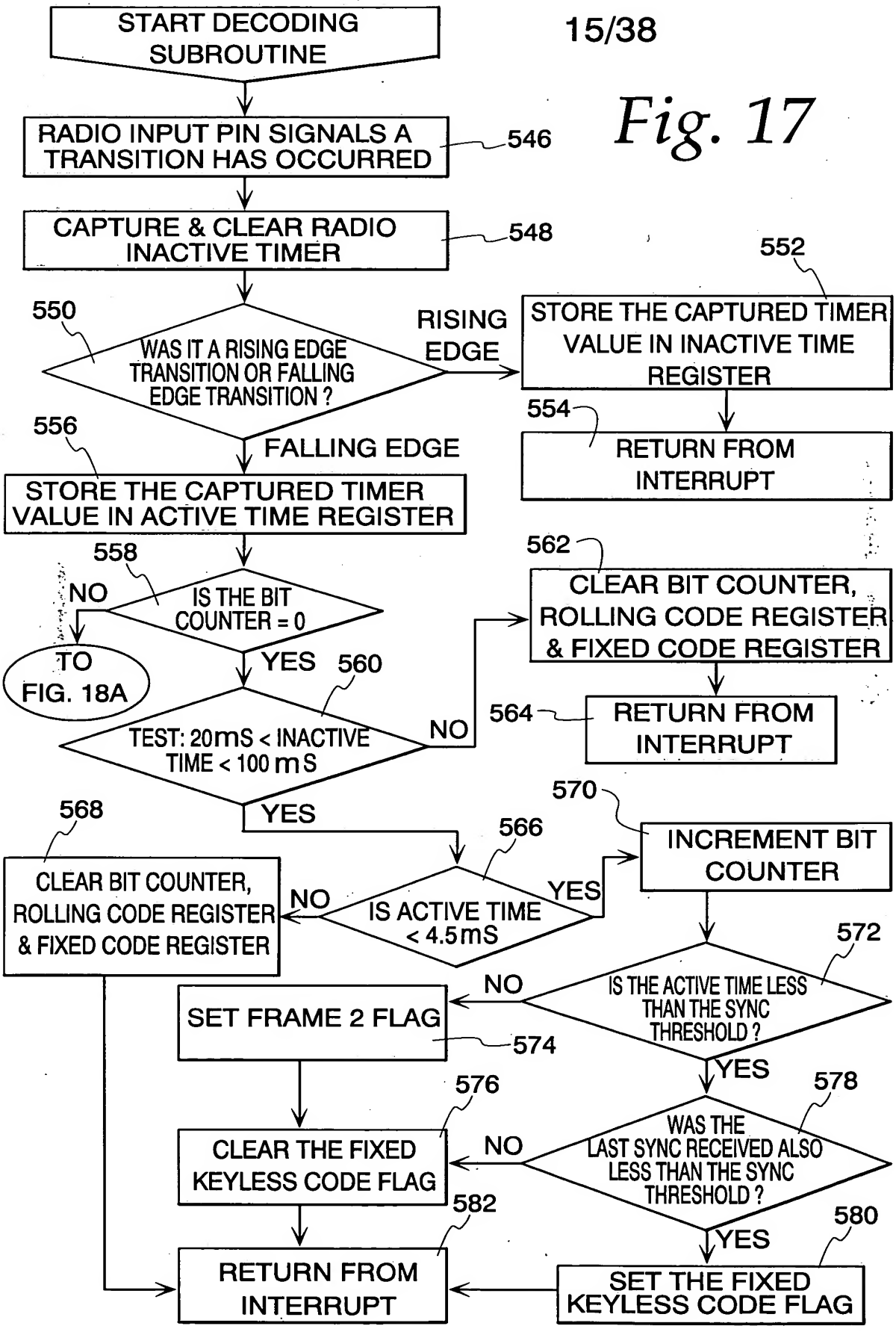

START DECODING SUBROUTINE
RADIO INPUT PIN SIGNALS A TRANSITION HAS OCCURRED
546
CAPTURE & CLEAR RADIO INACTIVE TIMER
548
550
WAS IT A RISING EDGE TRANSITION OR FALLING EDGE TRANSITION ?
RISING EDGE
552
STORE THE CAPTURED TIMER VALUE IN INACTIVE TIME REGISTER
554
RETURN FROM INTERRUPT
FALLING EDGE
556
STORE THE CAPTURED TIMER VALUE IN ACTIVE TIME REGISTER
558
IS THE BIT COUNTER = 0
NO
TO FIG. 18A
YES
560
TEST: 20mS < INACTIVE TIME < 100 mS
NO
562
CLEAR BIT COUNTER, ROLLING CODE REGISTER & FIXED CODE REGISTER
564
RETURN FROM INTERRUPT
YES
570
INCREMENT BIT COUNTER
566
IS ACTIVE TIME < 4.5mS
YES
NO
568
CLEAR BIT COUNTER, ROLLING CODE REGISTER & FIXED CODE REGISTER
572
IS THE ACTIVE TIME LESS THAN THE SYNC THRESHOLD ?
NO
SET FRAME 2 FLAG
574
YES
576
578
WAS THE LAST SYNC RECEIVED ALSO LESS THAN THE SYNC THRESHOLD ?
CLEAR THE FIXED KEYLESS CODE FLAG
NO
582
YES
580
RETURN FROM INTERRUPT
SET THE FIXED KEYLESS CODE FLAG

Fig. 18A

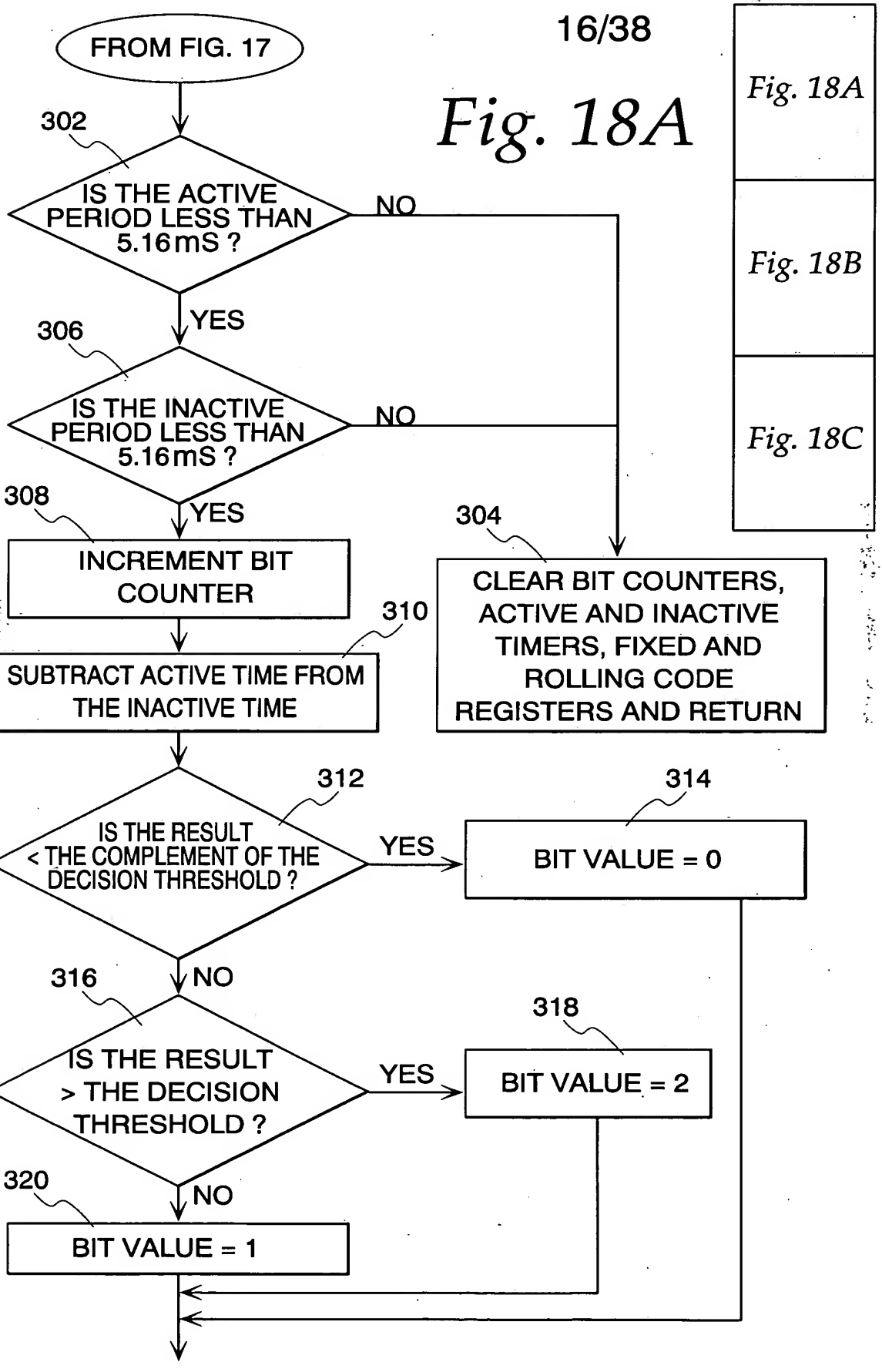


Fig. 18A
Fig. 18B
Fig. 18C

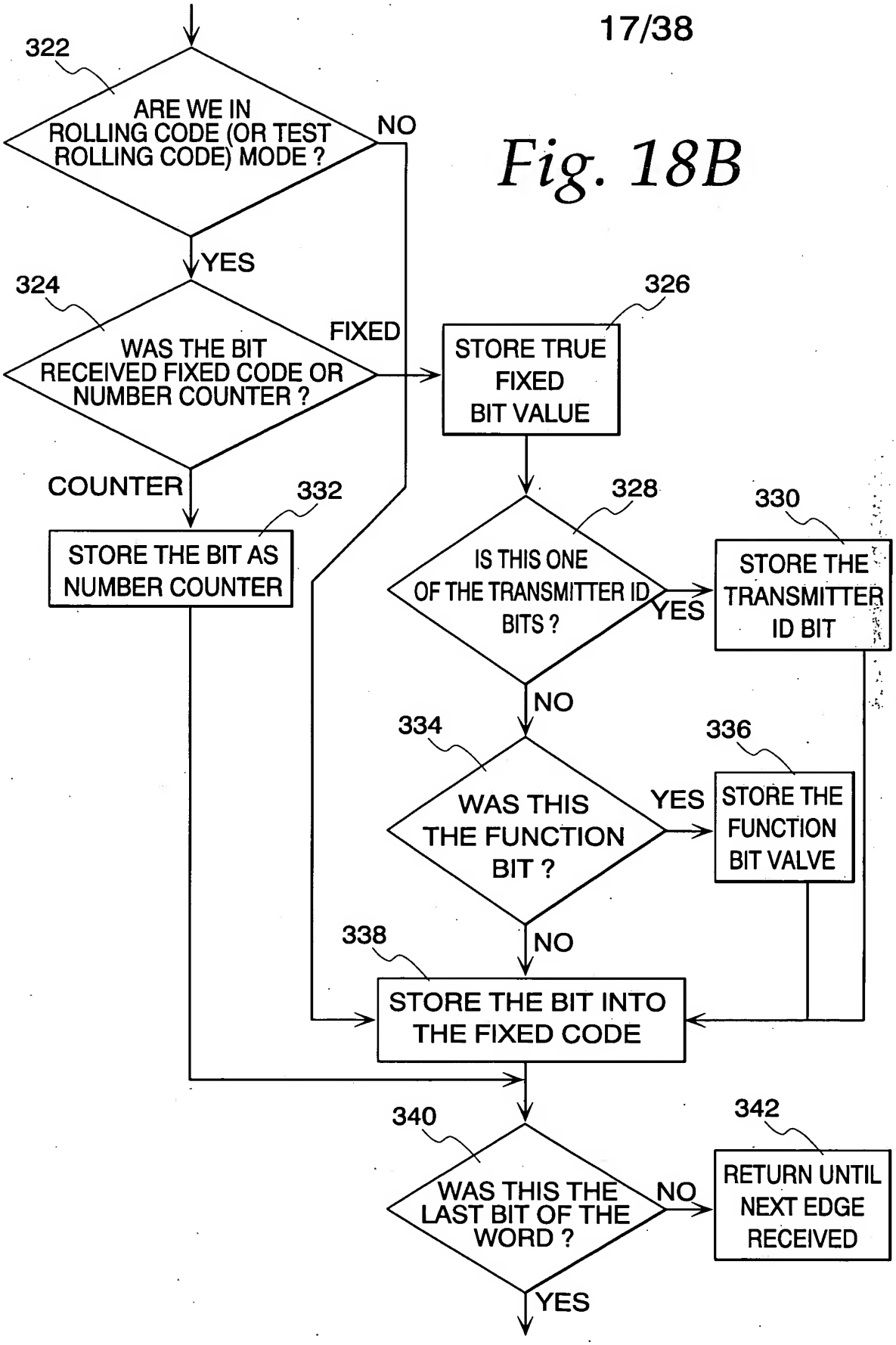

322
ARE WE IN ROLLING CODE (OR TEST ROLLING CODE) MODE ?
NO
YES
324
WAS THE BIT RECEIVED FIXED CODE OR NUMBER COUNTER ?
FIXED
COUNTER
326
STORE TRUE FIXED BIT VALUE
332
STORE THE BIT AS NUMBER COUNTER
328
IS THIS ONE OF THE TRANSMITTER ID BITS ?
YES
330
STORE THE TRANSMITTER ID BIT
NO
334
WAS THIS THE FUNCTION BIT ?
YES
336
STORE THE FUNCTION BIT VALVE
NO
338
STORE THE BIT INTO THE FIXED CODE
340
WAS THIS THE LAST BIT OF THE WORD ?
NO
342
RETURN UNTIL NEXT EDGE RECEIVED
YES

Fig. 18B

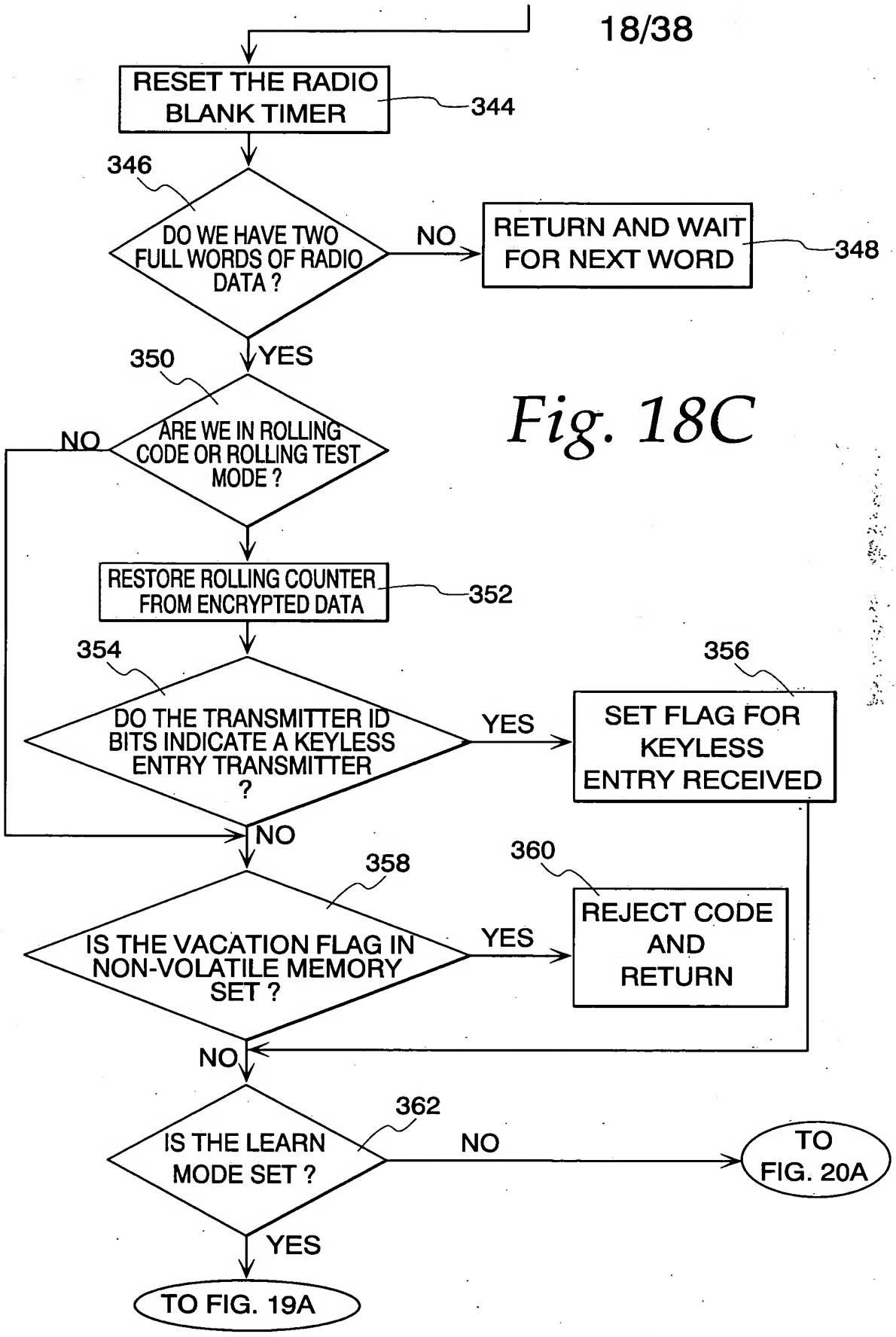

RESET THE RADIO BLANK TIMER
344
346
DO WE HAVE TWO FULL WORDS OF RADIO DATA ?
NO
RETURN AND WAIT FOR NEXT WORD
348
YES
350
ARE WE IN ROLLING CODE OR ROLLING TEST MODE ?
NO
RESTORE ROLLING COUNTER FROM ENCRYPTED DATA
352
354
DO THE TRANSMITTER ID BITS INDICATE A KEYLESS ENTRY TRANSMITTER ?
YES
356
SET FLAG FOR KEYLESS ENTRY RECEIVED
NO
358
IS THE VACATION FLAG IN NON-VOLATILE MEMORY SET ?
YES
360
REJECT CODE AND RETURN
NO
362
IS THE LEARN MODE SET ?
NO
TO FIG. 20A
YES
TO FIG. 19A

Fig. 18C

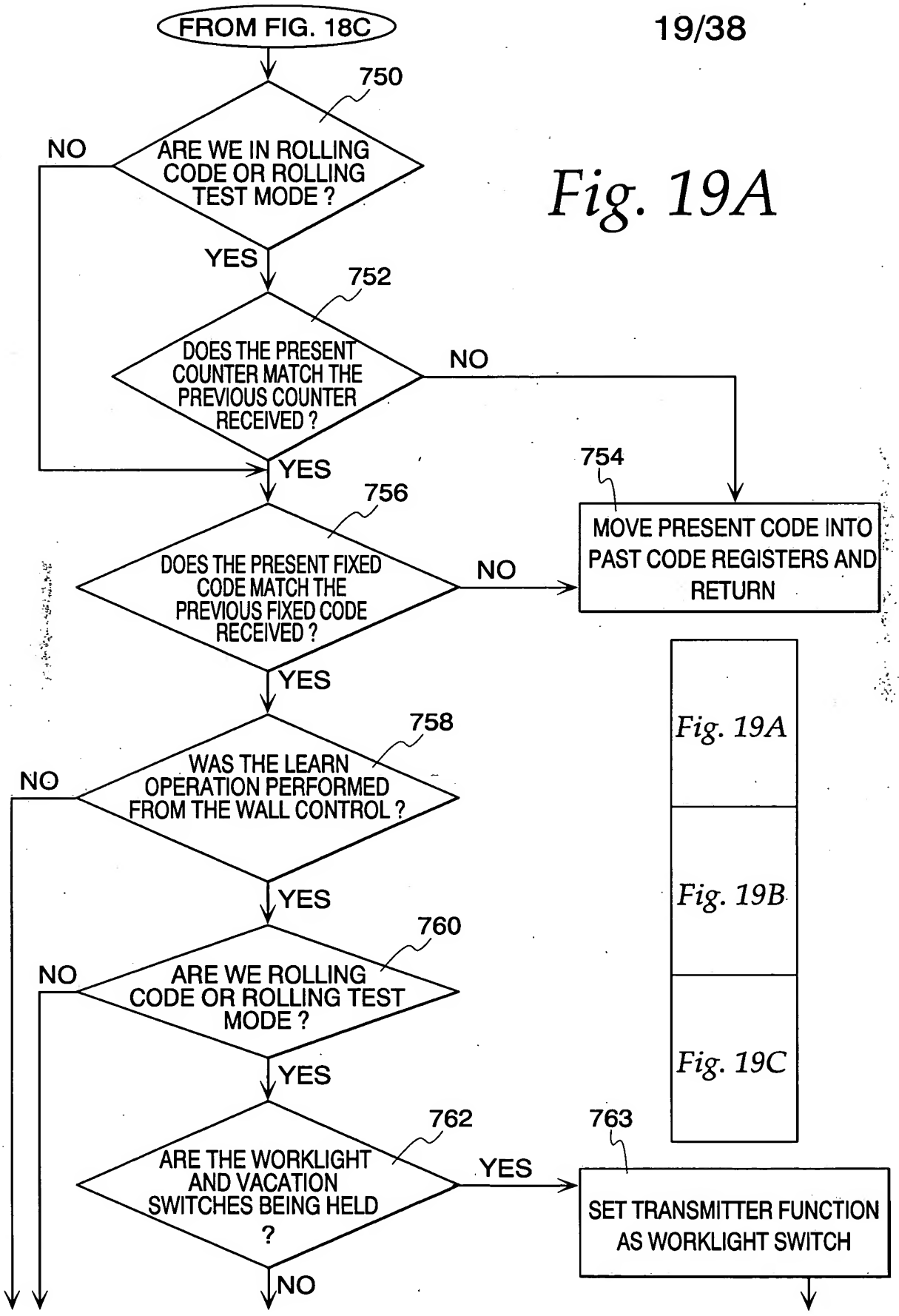


Fig. 19A

Fig. 19A
Fig. 19B
Fig. 19C

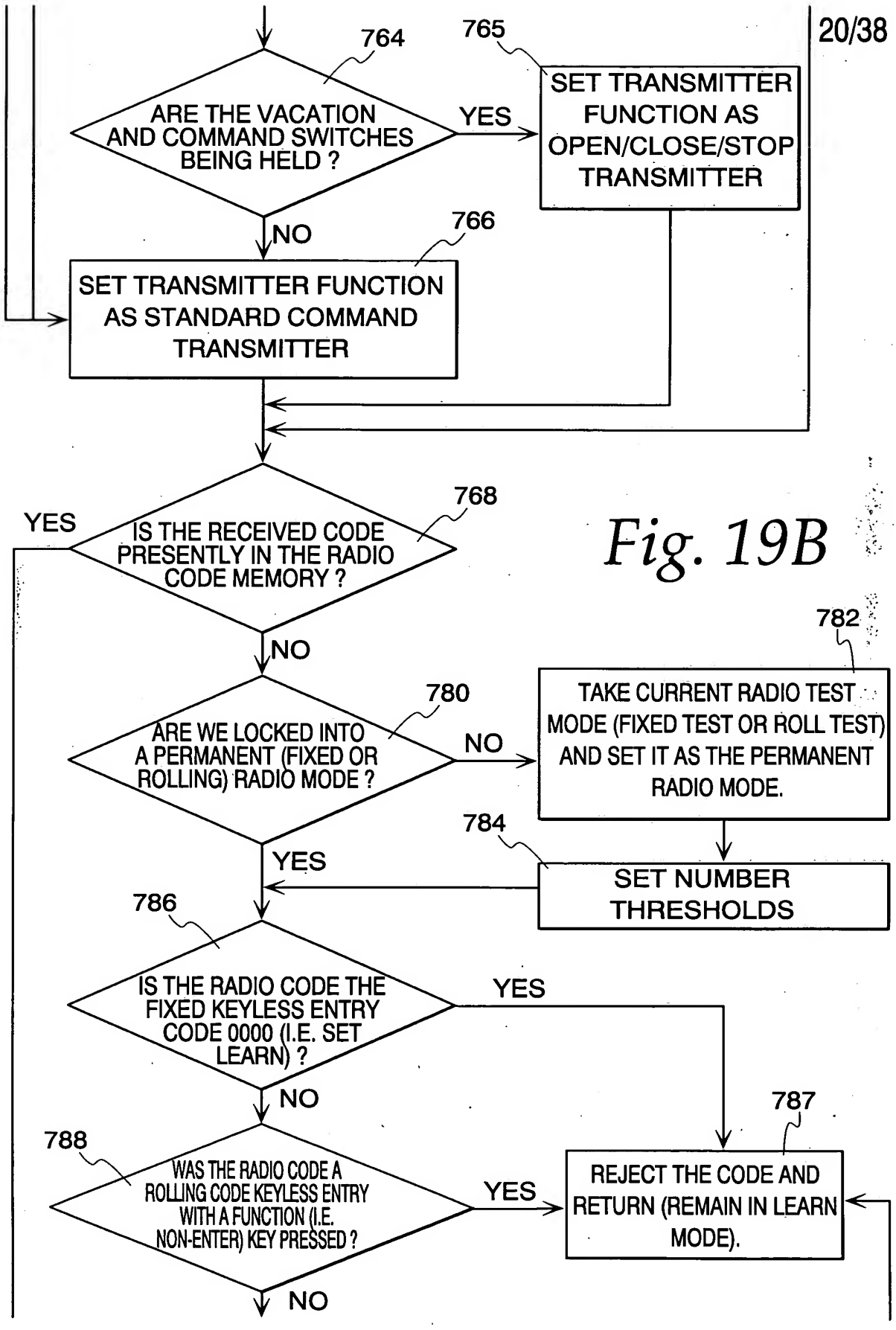

764
ARE THE VACATION AND COMMAND SWITCHES BEING HELD ?
YES
765
SET TRANSMITTER FUNCTION AS OPEN/CLOSE/STOP TRANSMITTER
NO
766
SET TRANSMITTER FUNCTION AS STANDARD COMMAND TRANSMITTER
768
IS THE RECEIVED CODE PRESENTLY IN THE RADIO CODE MEMORY ?
YES
NO
780
ARE WE LOCKED INTO A PERMANENT (FIXED OR ROLLING) RADIO MODE ?
NO
782
TAKE CURRENT RADIO TEST MODE (FIXED TEST OR ROLL TEST) AND SET IT AS THE PERMANENT RADIO MODE.
784
SET NUMBER THRESHOLDS
YES
786
IS THE RADIO CODE THE FIXED KEYLESS ENTRY CODE 0000 (I.E. SET LEARN) ?
YES
NO
787
REJECT THE CODE AND RETURN (REMAIN IN LEARN MODE).
788
WAS THE RADIO CODE A ROLLING CODE KEYLESS ENTRY WITH A FUNCTION (I.E. NON-ENTER) KEY PRESSED ?
YES
NO

Fig. 19B

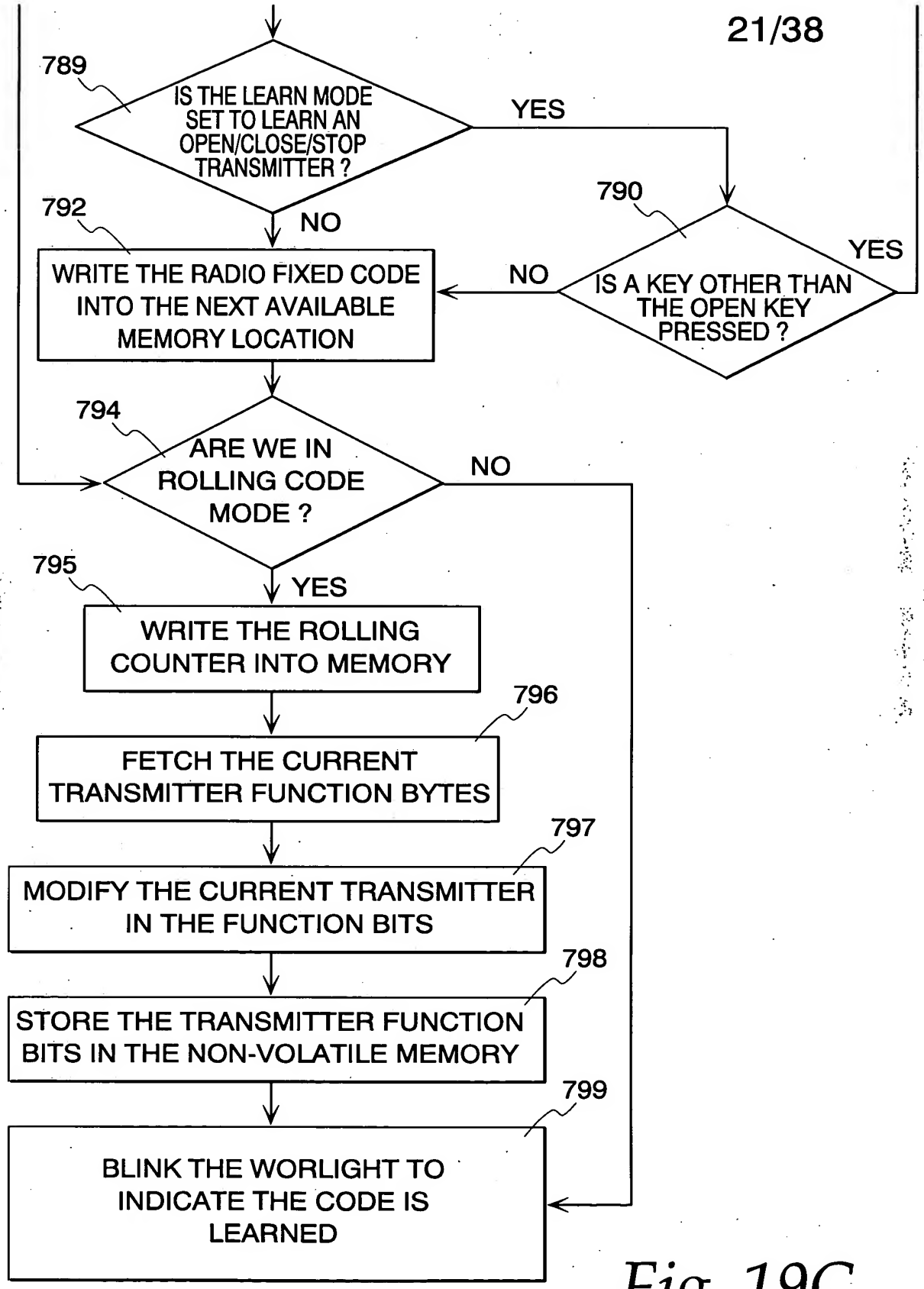

789
IS THE LEARN MODE SET TO LEARN AN OPEN/CLOSE/STOP TRANSMITTER ?
YES
NO
790
IS A KEY OTHER THAN THE OPEN KEY PRESSED ?
YES
NO
792
WRITE THE RADIO FIXED CODE INTO THE NEXT AVAILABLE MEMORY LOCATION
794
ARE WE IN ROLLING CODE MODE ?
NO
YES
795
WRITE THE ROLLING COUNTER INTO MEMORY
796
FETCH THE CURRENT TRANSMITTER FUNCTION BYTES
797
MODIFY THE CURRENT TRANSMITTER IN THE FUNCTION BITS
798
STORE THE TRANSMITTER FUNCTION BITS IN THE NON-VOLATILE MEMORY
799
BLINK THE WORLIGHT TO INDICATE THE CODE IS LEARNED

Fig. 19C

Fig. 20A

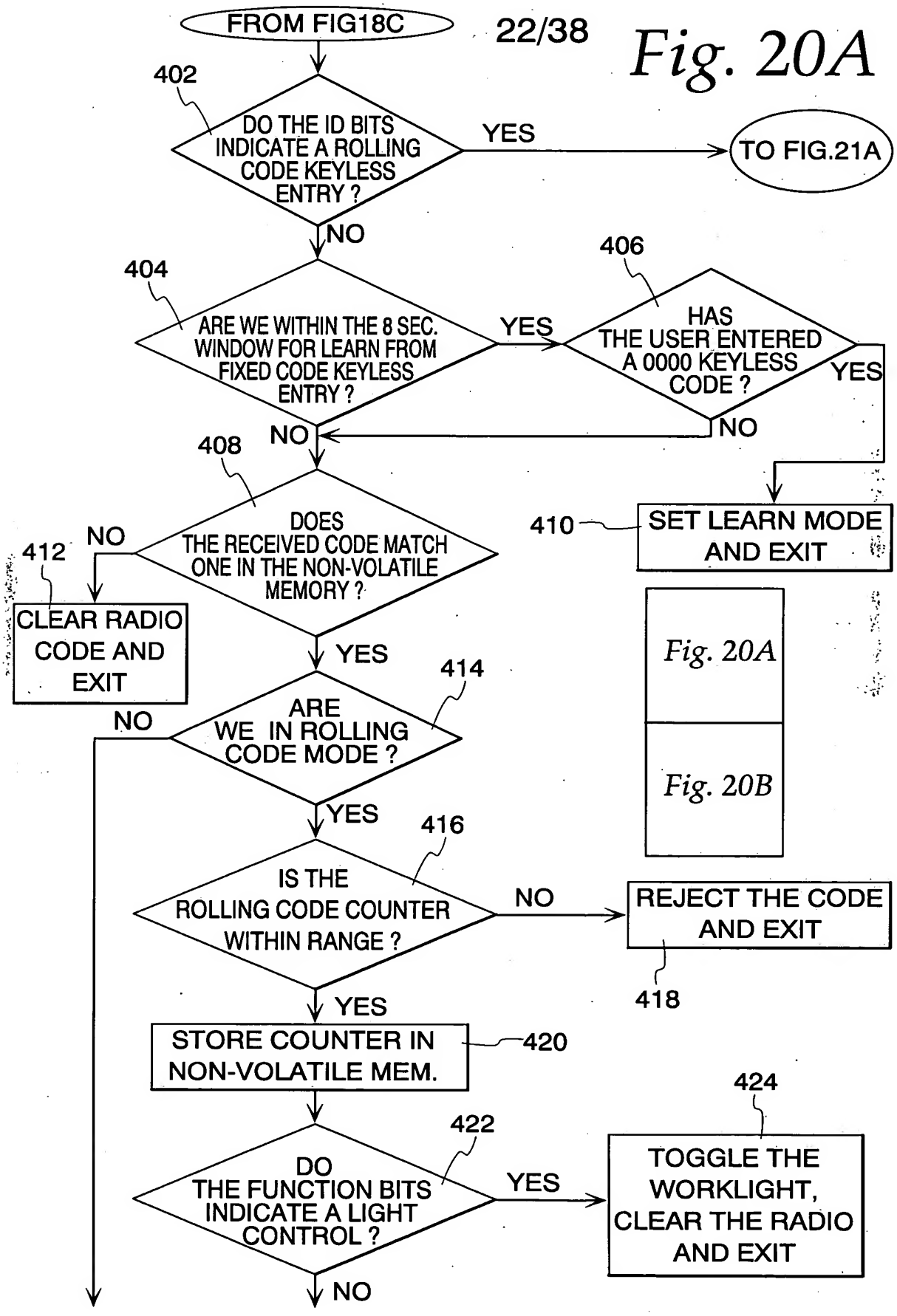


Fig. 20A

Fig. 20B

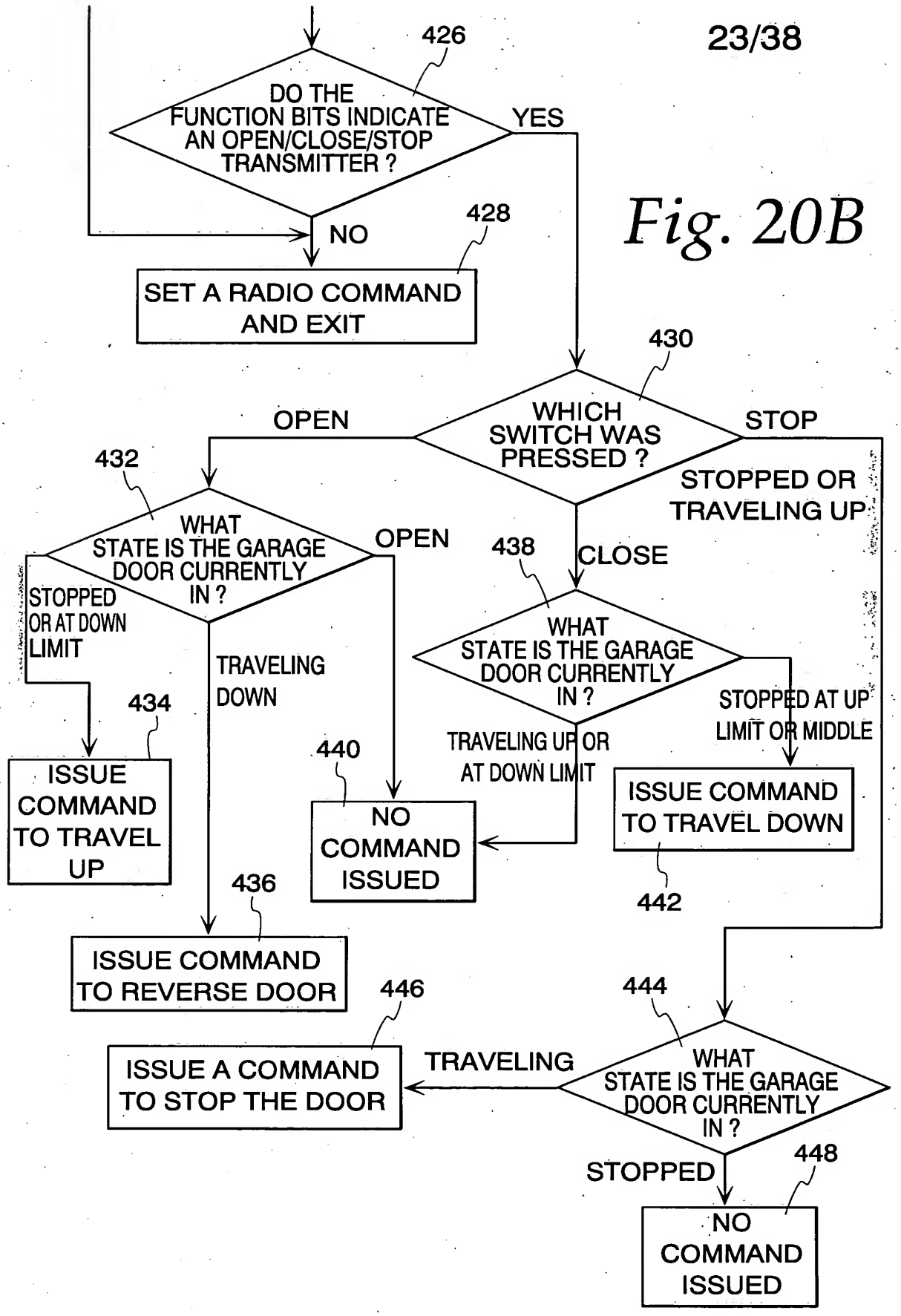
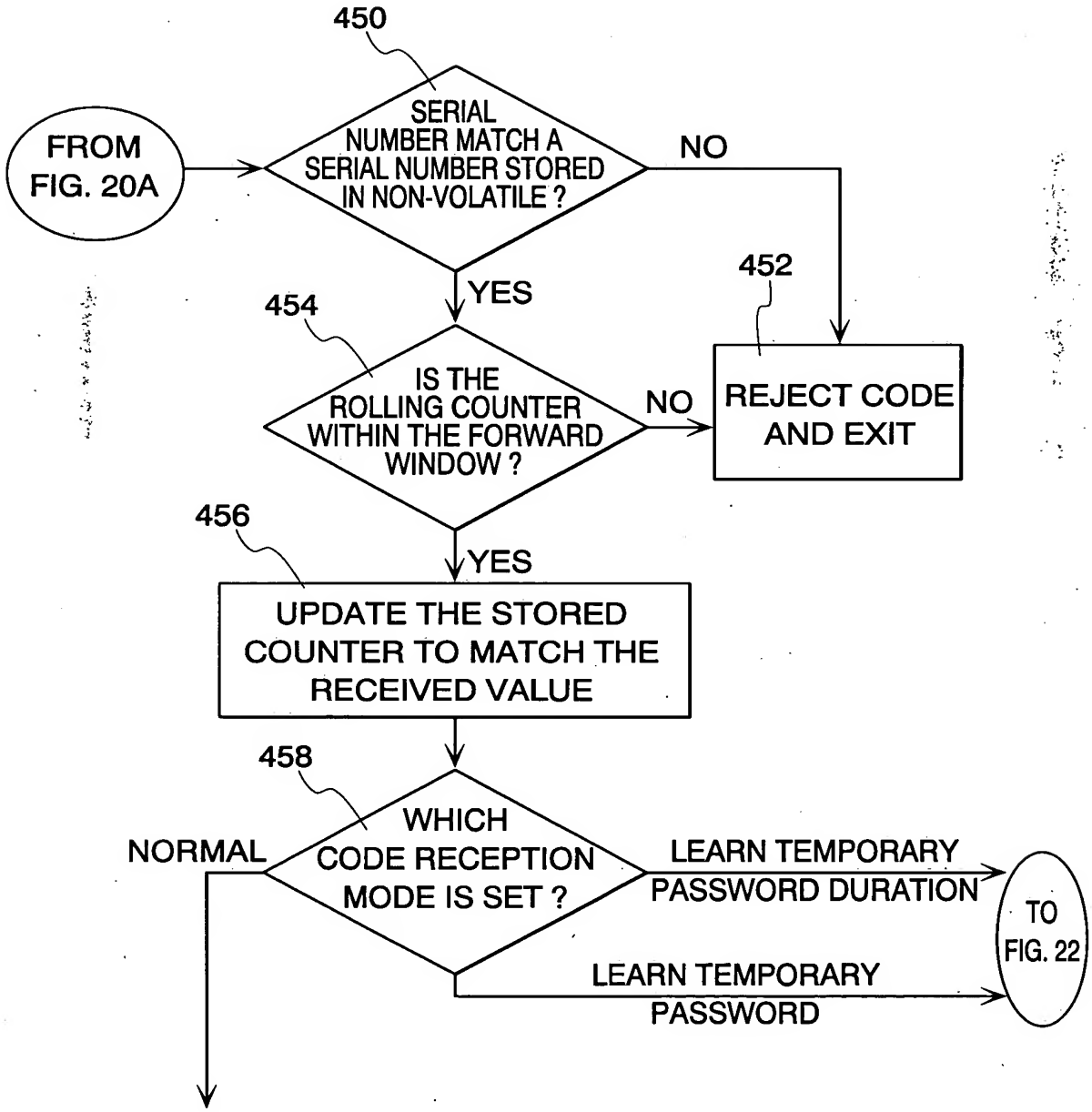

426
DO THE FUNCTION BITS INDICATE AN OPEN/CLOSE/STOP TRANSMITTER ?
YES
NO
428
SET A RADIO COMMAND AND EXIT
430
WHICH SWITCH WAS PRESSED ?
OPEN
STOP
STOPPED OR TRAVELING UP
CLOSE
432
WHAT STATE IS THE GARAGE DOOR CURRENTLY IN ?
OPEN
STOPPED OR AT DOWN LIMIT
TRAVELING DOWN
438
WHAT STATE IS THE GARAGE DOOR CURRENTLY IN ?
TRAVELING UP OR AT DOWN LIMIT
STOPPED AT UP LIMIT OR MIDDLE
434
ISSUE COMMAND TO TRAVEL UP
440
NO COMMAND ISSUED
ISSUE COMMAND TO TRAVEL DOWN
442
436
ISSUE COMMAND TO REVERSE DOOR
446
ISSUE A COMMAND TO STOP THE DOOR
TRAVELING
444
WHAT STATE IS THE GARAGE DOOR CURRENTLY IN ?
STOPPED
448
NO COMMAND ISSUED

Fig. 20B

Fig. 21A

Fig. 21A
Fig. 21B



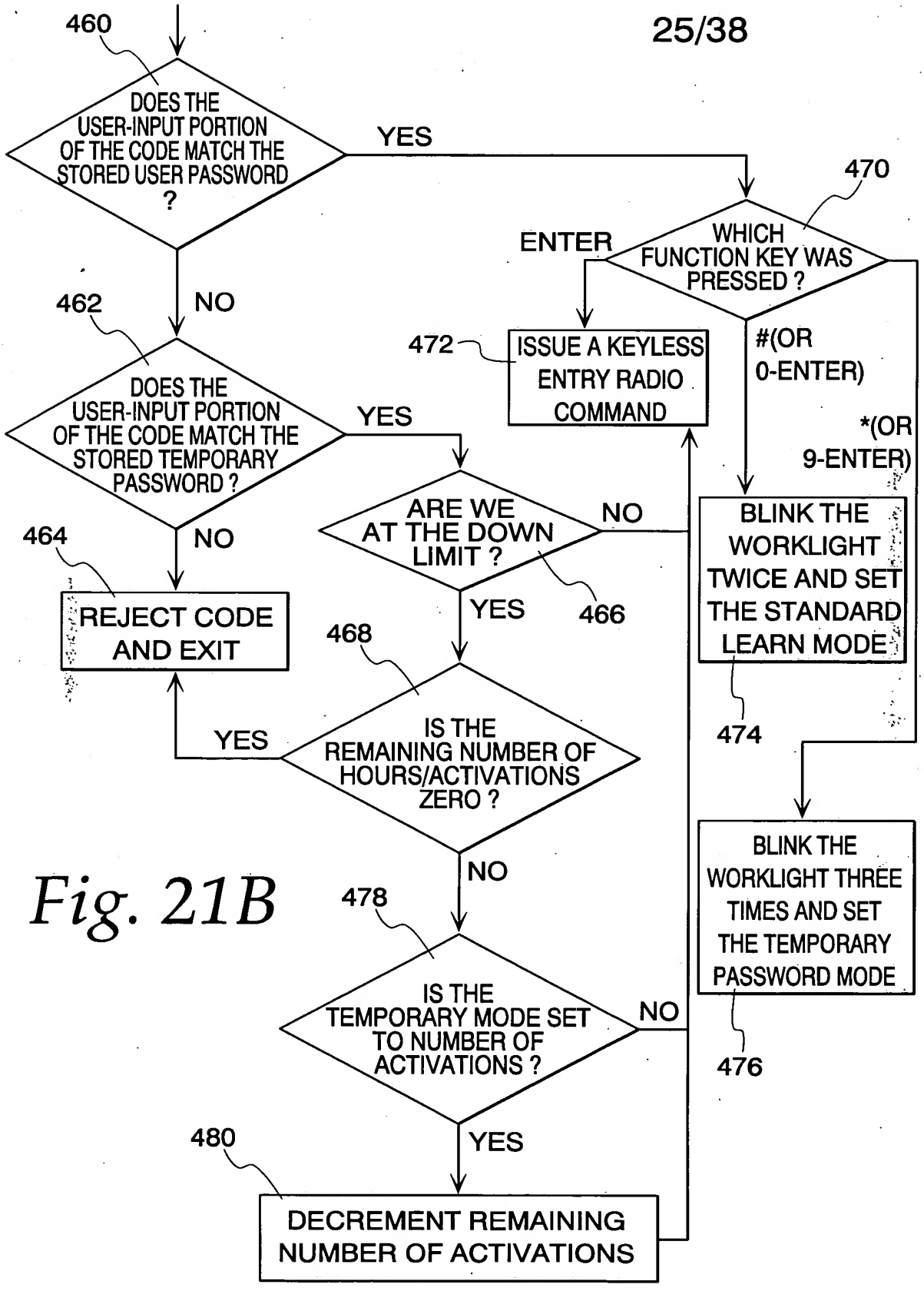

460
DOES THE USER-INPUT PORTION OF THE CODE MATCH THE STORED USER PASSWORD ?
YES
NO
462
DOES THE USER-INPUT PORTION OF THE CODE MATCH THE STORED TEMPORARY PASSWORD ?
YES
NO
464
REJECT CODE AND EXIT
ARE WE AT THE DOWN LIMIT ?
NO
YES
466
468
IS THE REMAINING NUMBER OF HOURS/ACTIVATIONS ZERO ?
YES
NO
478
IS THE TEMPORARY MODE SET TO NUMBER OF ACTIVATIONS ?
NO
YES
480
DECREMENT REMAINING NUMBER OF ACTIVATIONS
470
WHICH FUNCTION KEY WAS PRESSED ?
ENTER
#(OR 0-ENTER)
*(OR 9-ENTER)
472
ISSUE A KEYLESS ENTRY RADIO COMMAND
BLINK THE WORKLIGHT TWICE AND SET THE STANDARD LEARN MODE
474
BLINK THE WORKLIGHT THREE TIMES AND SET THE TEMPORARY PASSWORD MODE
476

Fig. 21B

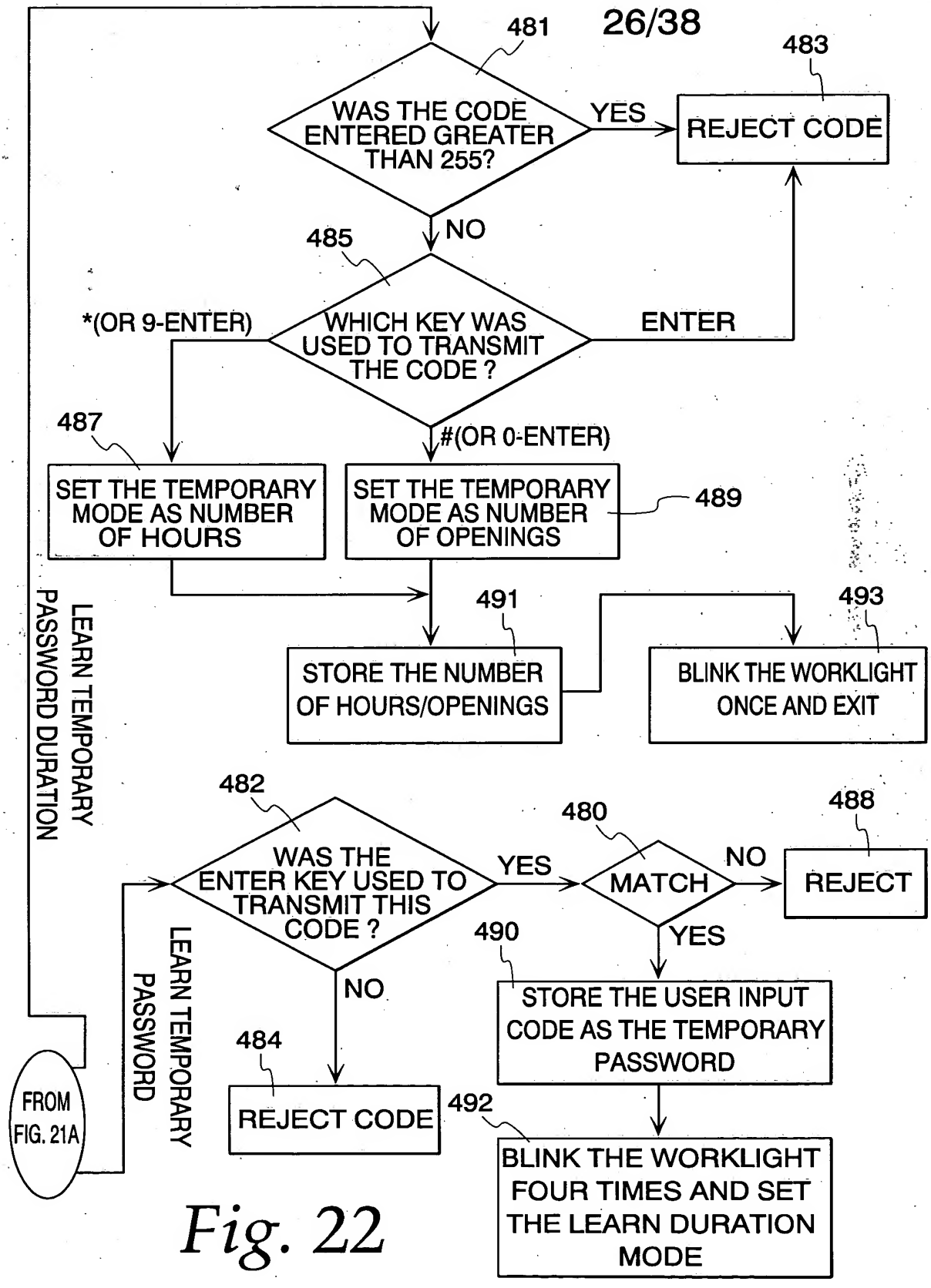

481
WAS THE CODE ENTERED GREATER THAN 255?
YES
483
REJECT CODE
NO
485
WHICH KEY WAS USED TO TRANSMIT THE CODE ?
*(OR 9-ENTER)
ENTER
#(OR 0-ENTER)
487
SET THE TEMPORARY MODE AS NUMBER OF HOURS
SET THE TEMPORARY MODE AS NUMBER OF OPENINGS
489
491
STORE THE NUMBER OF HOURS/OPENINGS
493
BLINK THE WORKLIGHT ONCE AND EXIT
LEARN TEMPORARY PASSWORD DURATION
482
WAS THE ENTER KEY USED TO TRANSMIT THIS CODE ?
YES
480
MATCH
NO
488
REJECT
YES
490
STORE THE USER INPUT CODE AS THE TEMPORARY PASSWORD
NO
484
REJECT CODE
492
BLINK THE WORKLIGHT FOUR TIMES AND SET THE LEARN DURATION MODE
LEARN TEMPORARY PASSWORD
FROM FIG. 21A

Fig. 22

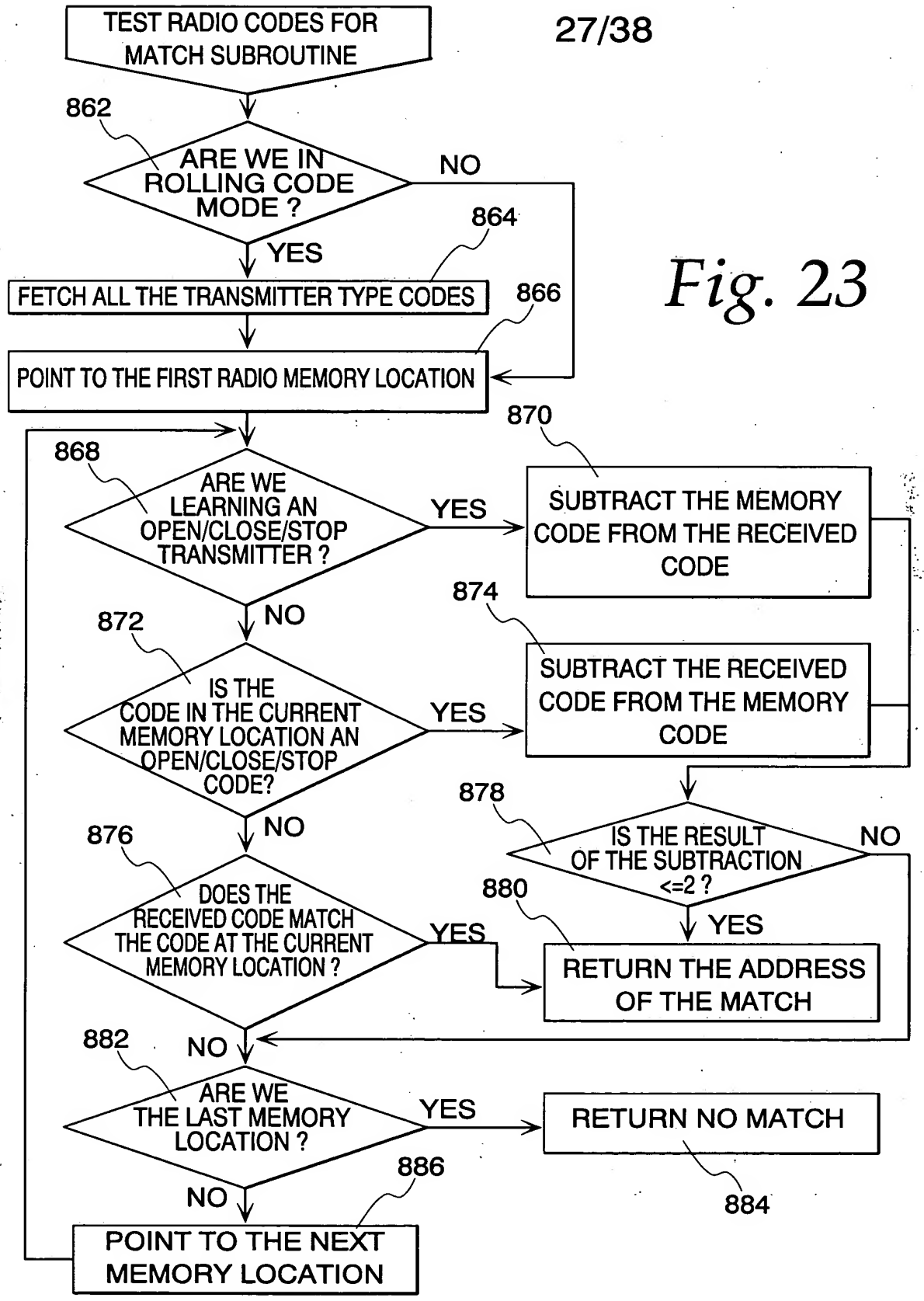

TEST RADIO CODES FOR MATCH SUBROUTINE
862
ARE WE IN ROLLING CODE MODE ?
NO
YES
864
FETCH ALL THE TRANSMITTER TYPE CODES
866
POINT TO THE FIRST RADIO MEMORY LOCATION
868
ARE WE LEARNING AN OPEN/CLOSE/STOP TRANSMITTER ?
YES
870
SUBTRACT THE MEMORY CODE FROM THE RECEIVED CODE
NO
872
IS THE CODE IN THE CURRENT MEMORY LOCATION AN OPEN/CLOSE/STOP CODE?
YES
874
SUBTRACT THE RECEIVED CODE FROM THE MEMORY CODE
NO
876
DOES THE RECEIVED CODE MATCH THE CODE AT THE CURRENT MEMORY LOCATION ?
YES
878
IS THE RESULT OF THE SUBTRACTION <=2 ?
NO
YES
880
RETURN THE ADDRESS OF THE MATCH
NO
882
ARE WE THE LAST MEMORY LOCATION ?
YES
RETURN NO MATCH
884
NO
886
POINT TO THE NEXT MEMORY LOCATION

Fig. 23

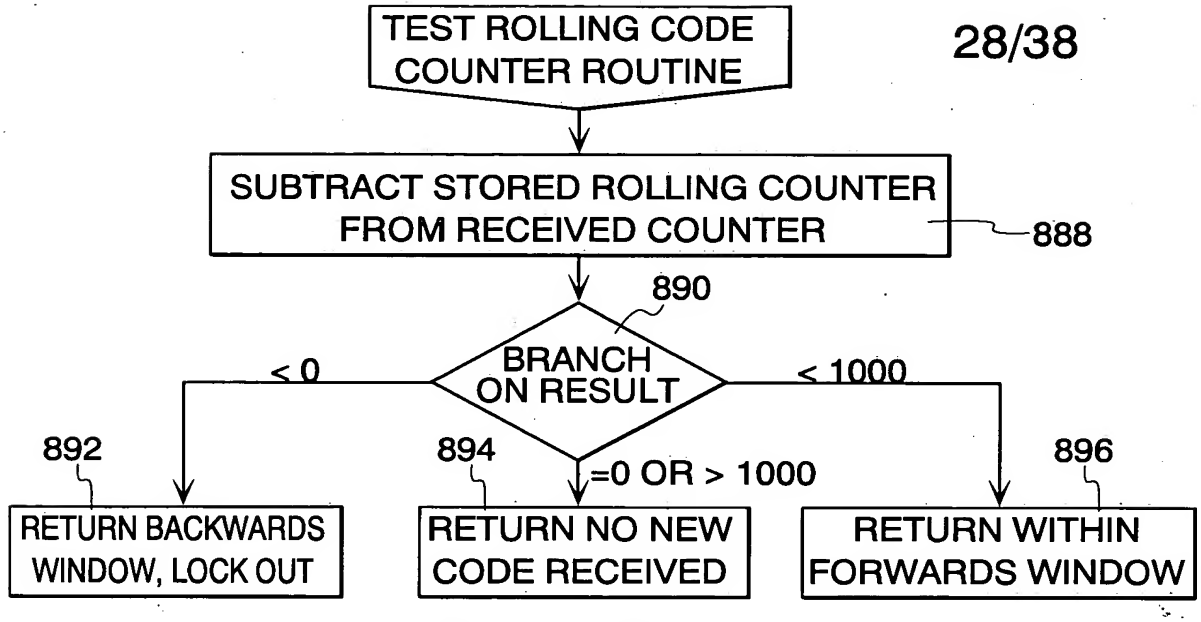

TEST ROLLING CODE COUNTER ROUTINE
SUBTRACT STORED ROLLING COUNTER FROM RECEIVED COUNTER
888
890
BRANCH ON RESULT
< 0
< 1000
892
894
=0 OR > 1000
896
RETURN BACKWARDS WINDOW, LOCK OUT
RETURN NO NEW CODE RECEIVED
RETURN WITHIN FORWARDS WINDOW

Fig. 24

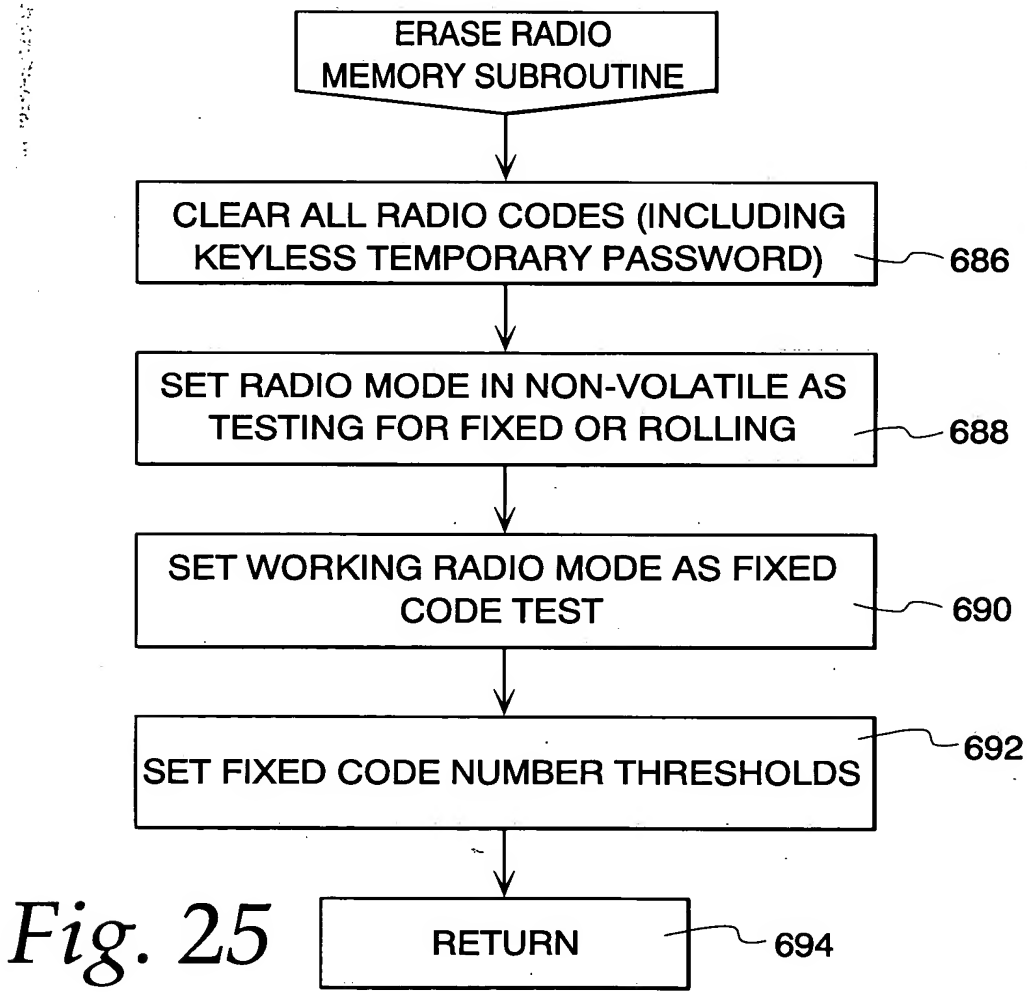
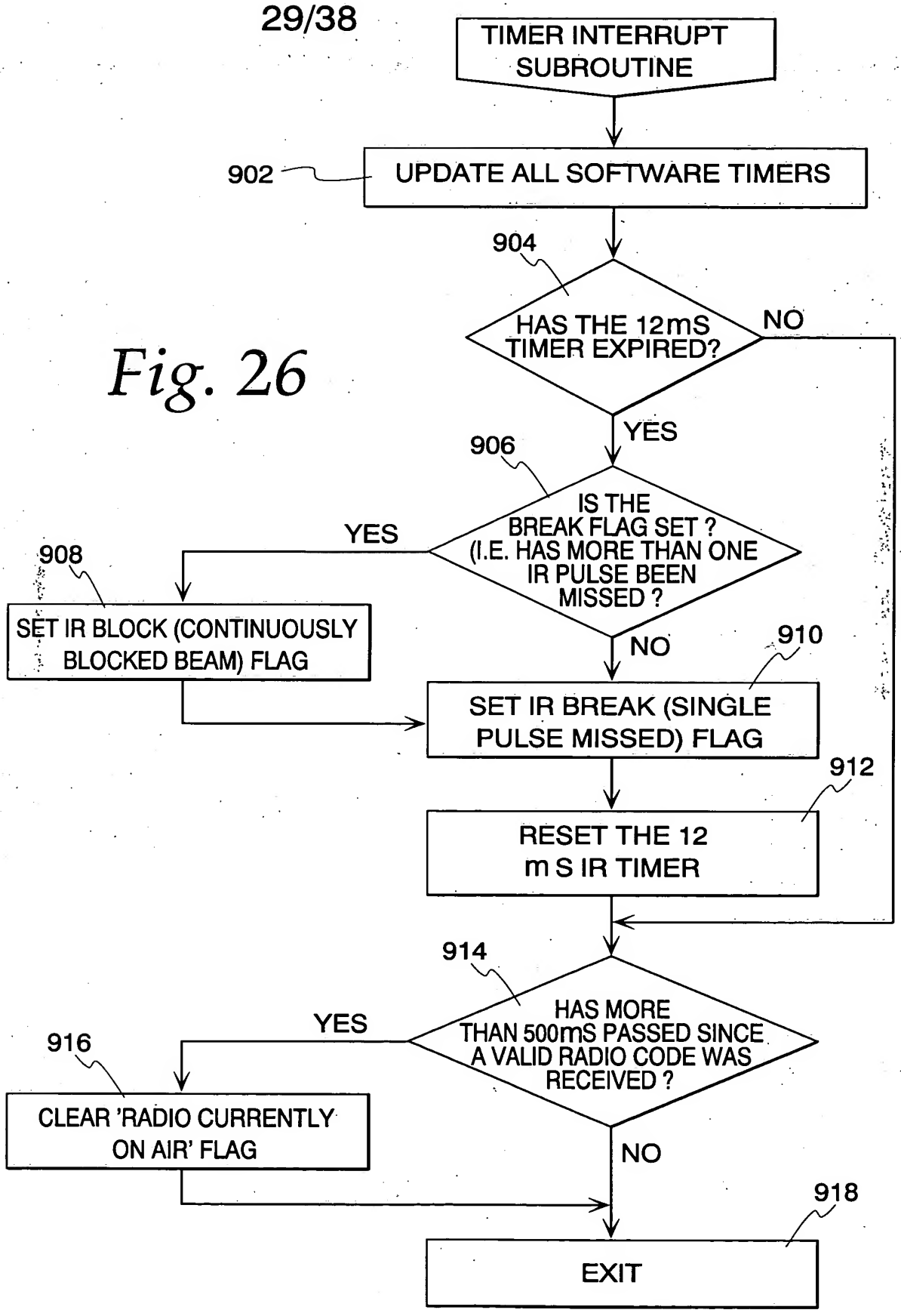

ERASE RADIO MEMORY SUBROUTINE
CLEAR ALL RADIO CODES (INCLUDING KEYLESS TEMPORARY PASSWORD)
686
SET RADIO MODE IN NON-VOLATILE AS TESTING FOR FIXED OR ROLLING
688
SET WORKING RADIO MODE AS FIXED CODE TEST
690
SET FIXED CODE NUMBER THRESHOLDS
692
RETURN
694

Fig. 25

Fig. 26


TIMER INTERRUPT SUBROUTINE
902
UPDATE ALL SOFTWARE TIMERS
904
HAS THE 12mS TIMER EXPIRED?
NO
YES
906
IS THE BREAK FLAG SET ? (I.E. HAS MORE THAN ONE IR PULSE BEEN MISSED ?
YES
908
SET IR BLOCK (CONTINUOUSLY BLOCKED BEAM) FLAG
NO
910
SET IR BREAK (SINGLE PULSE MISSED) FLAG
912
RESET THE 12 m S IR TIMER
914
HAS MORE THAN 500mS PASSED SINCE A VALID RADIO CODE WAS RECEIVED ?
YES
916
CLEAR 'RADIO CURRENTLY ON AIR' FLAG
NO
918
EXIT

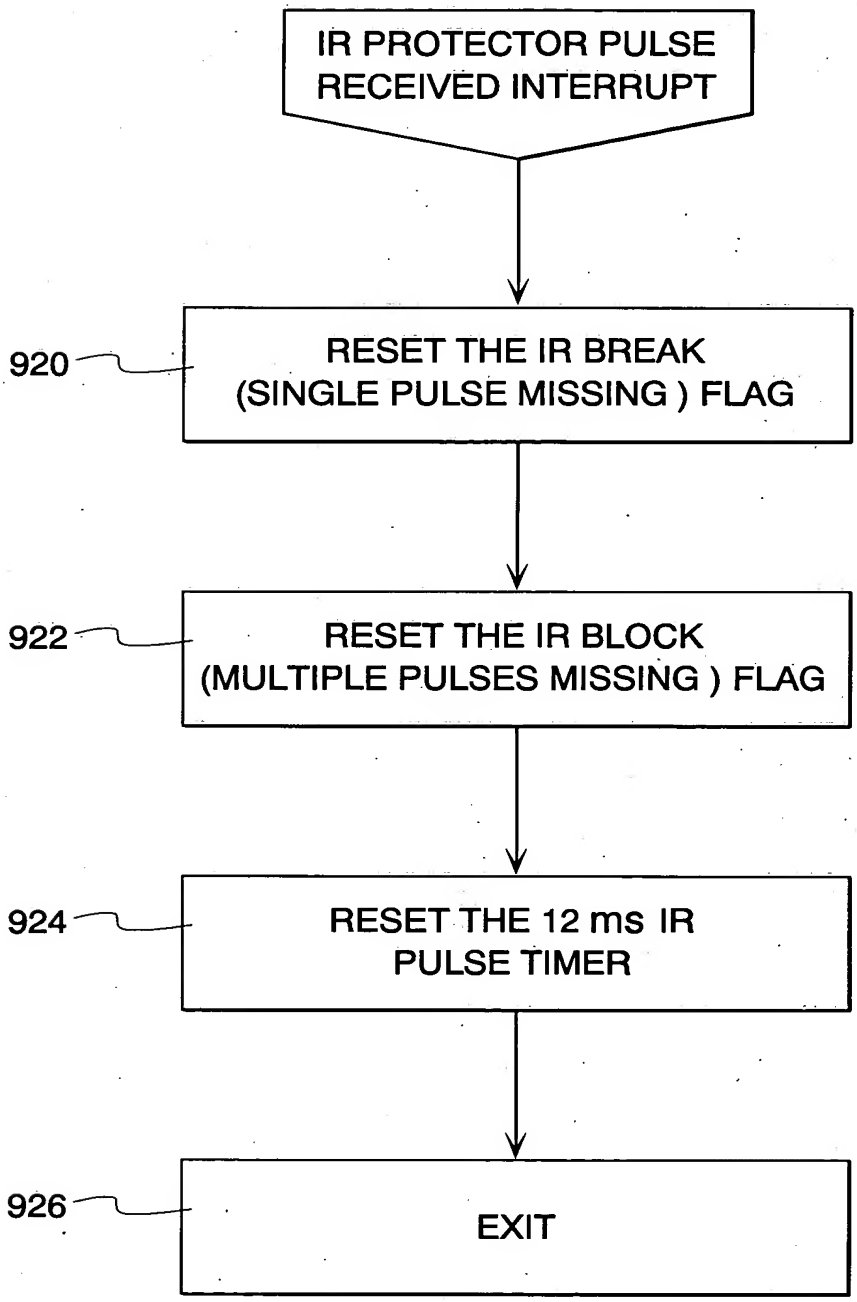
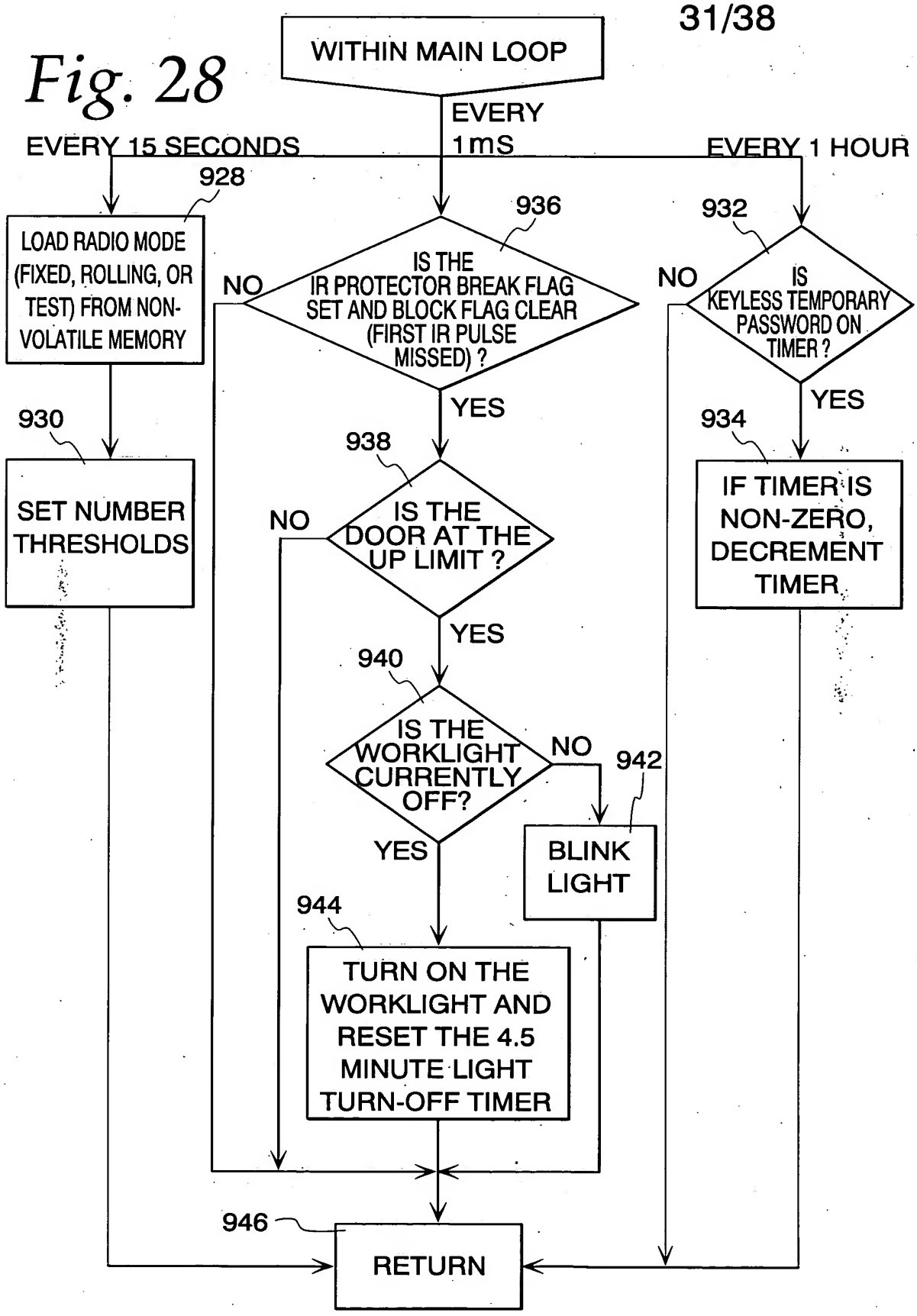

IR PROTECTOR PULSE RECEIVED INTERRUPT
920
RESET THE IR BREAK (SINGLE PULSE MISSING) FLAG
922
RESET THE IR BLOCK (MULTIPLE PULSES MISSING) FLAG
924
RESET THE 12 ms IR PULSE TIMER
926
EXIT

Fig. 27

Fig. 28


WITHIN MAIN LOOP
EVERY 1mS
EVERY 15 SECONDS
EVERY 1 HOUR
928
LOAD RADIO MODE (FIXED, ROLLING, OR TEST) FROM NON-VOLATILE MEMORY
930
SET NUMBER THRESHOLDS
936
IS THE IR PROTECTOR BREAK FLAG SET AND BLOCK FLAG CLEAR (FIRST IR PULSE MISSED) ?
NO
YES
938
IS THE DOOR AT THE UP LIMIT ?
NO
YES
940
IS THE WORKLIGHT CURRENTLY OFF?
NO
YES
942
BLINK LIGHT
944
TURN ON THE WORKLIGHT AND RESET THE 4.5 MINUTE LIGHT TURN-OFF TIMER
932
IS KEYLESS TEMPORARY PASSWORD ON TIMER ?
NO
YES
934
IF TIMER IS NON-ZERO, DECREMENT TIMER
946
RETURN

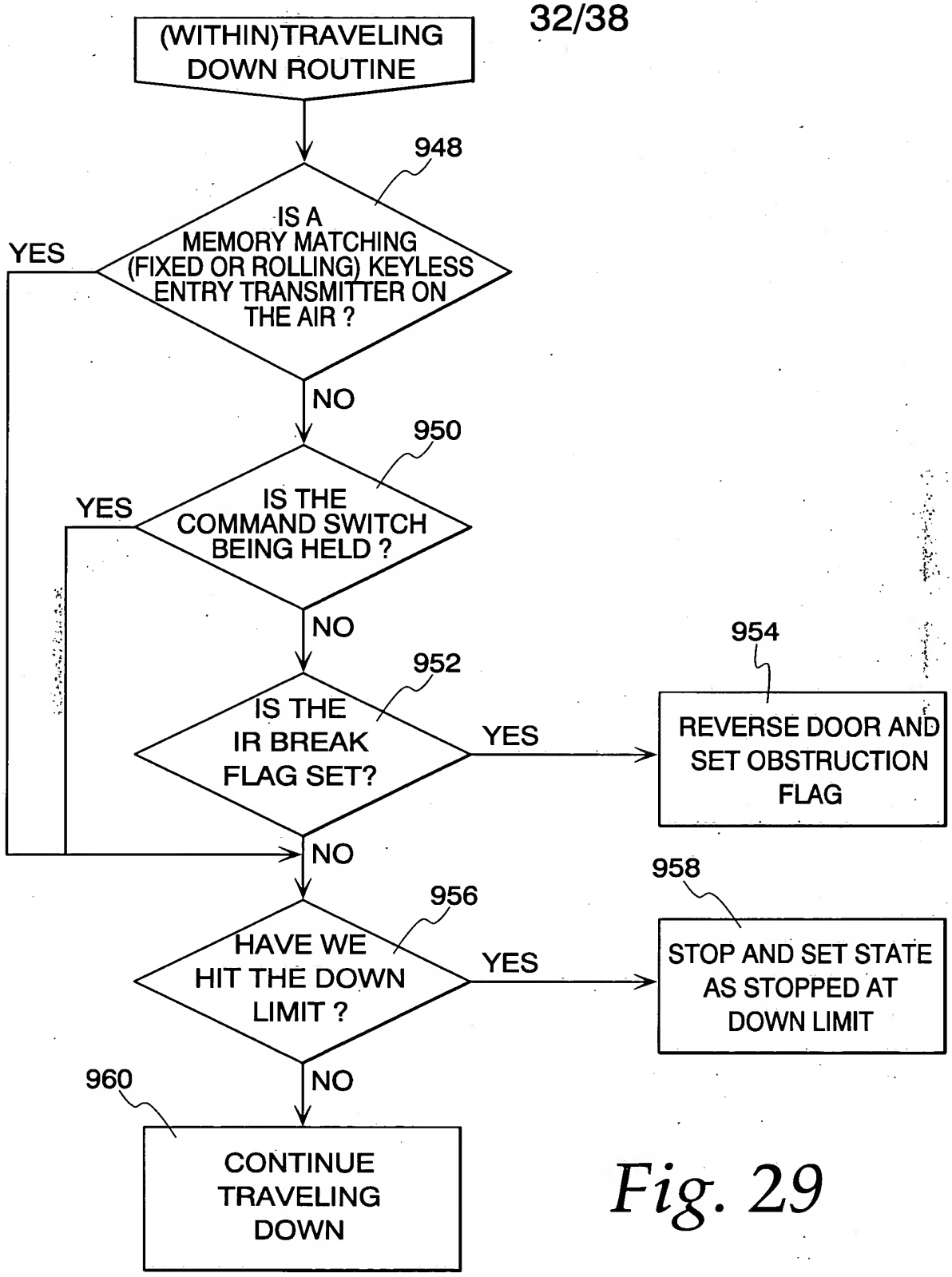

(WITHIN)TRAVELING DOWN ROUTINE
948
IS A MEMORY MATCHING (FIXED OR ROLLING) KEYLESS ENTRY TRANSMITTER ON THE AIR ?
YES
NO
950
IS THE COMMAND SWITCH BEING HELD ?
YES
NO
952
IS THE IR BREAK FLAG SET?
YES
954
REVERSE DOOR AND SET OBSTRUCTION FLAG
NO
956
HAVE WE HIT THE DOWN LIMIT ?
YES
958
STOP AND SET STATE AS STOPPED AT DOWN LIMIT
NO
960
CONTINUE TRAVELING DOWN

Fig. 29

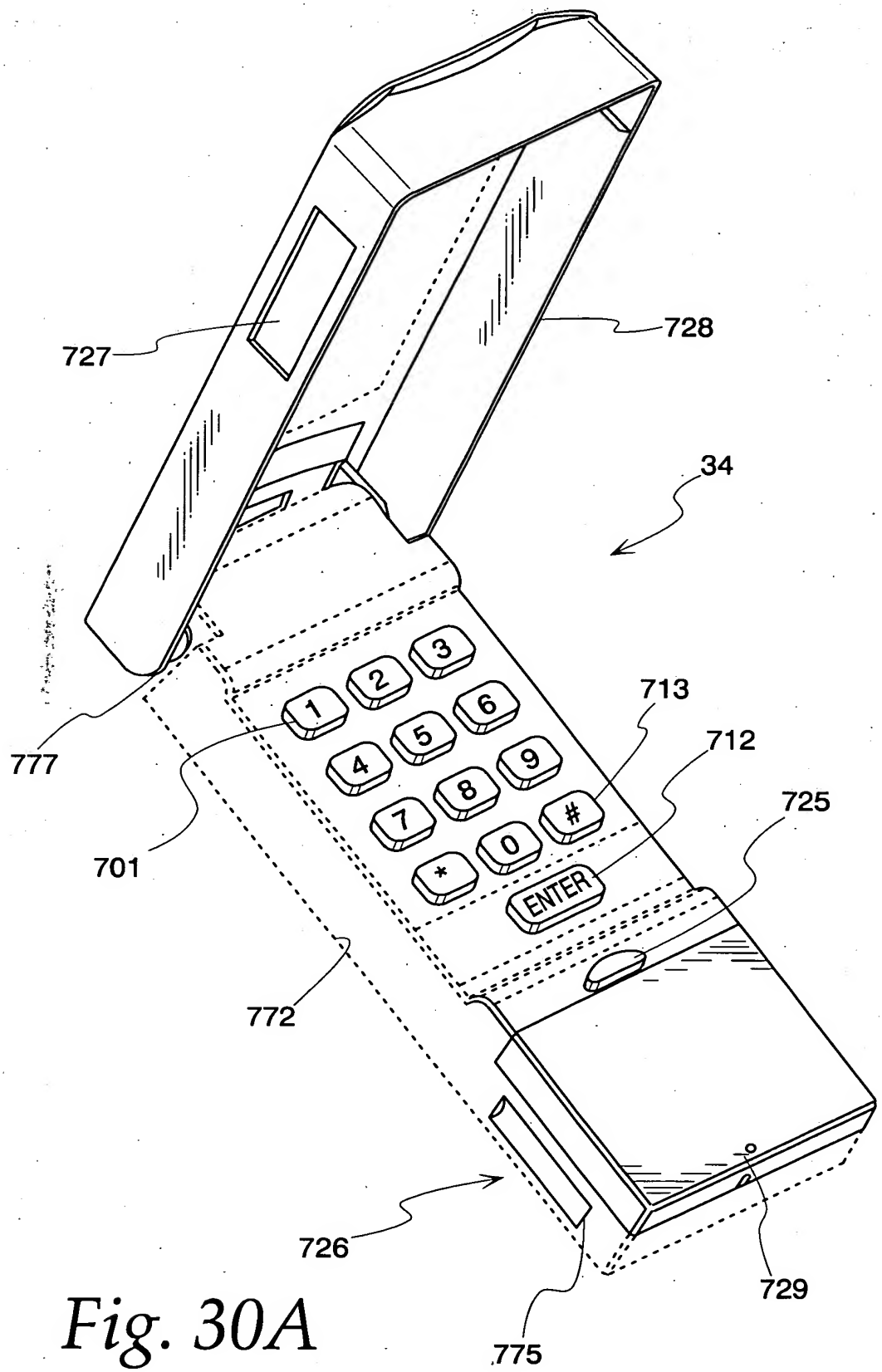

727
728
34
777
713
712
725
701
772
726
729
775
1
2
3
4
5
6
7
8
9
*
0
#
ENTER

Fig. 30A

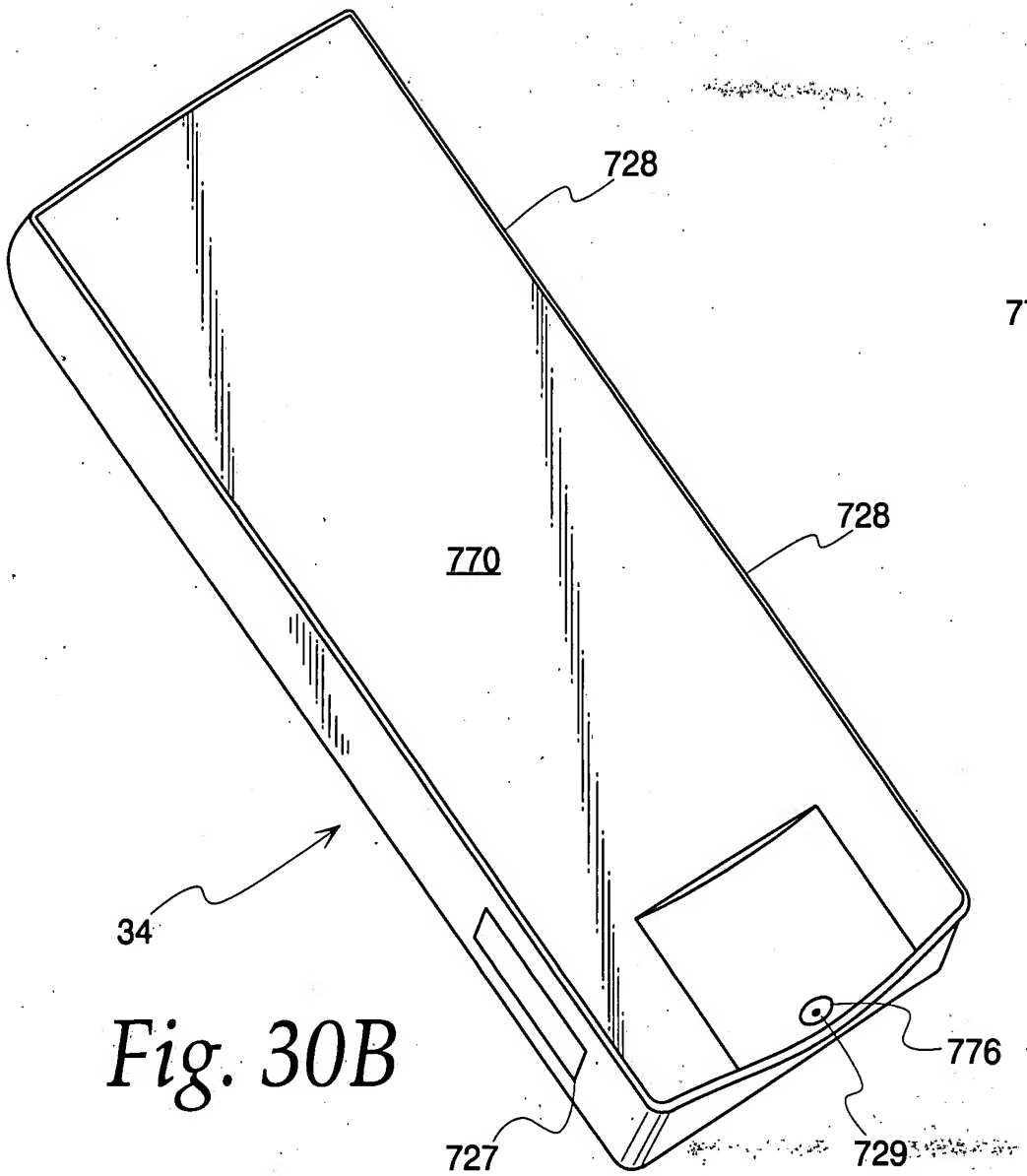


Fig. 30B

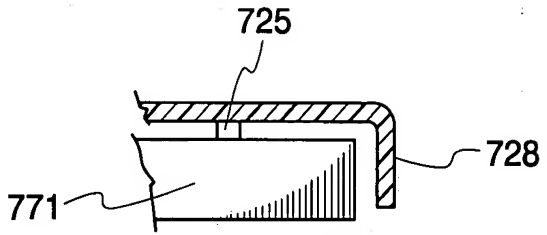


Fig. 31A

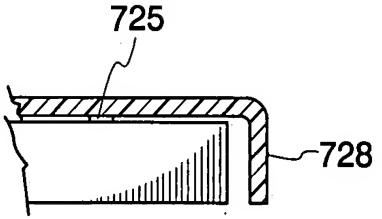


Fig. 31B

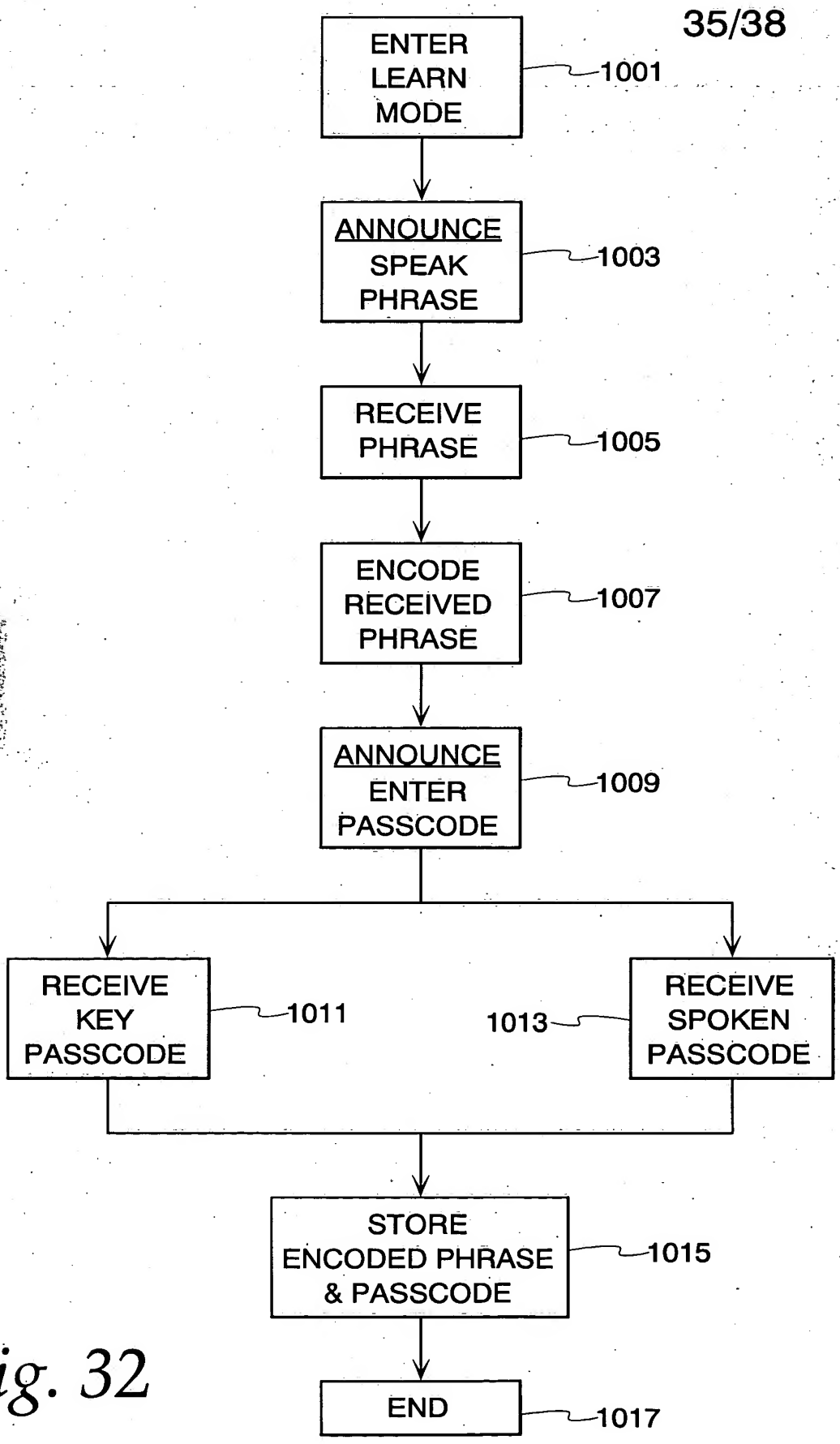

ENTER LEARN MODE
1001
ANNOUNCE SPEAK PHRASE
1003
RECEIVE PHRASE
1005
ENCODE RECEIVED PHRASE
1007
ANNOUNCE ENTER PASSCODE
1009
RECEIVE KEY PASSCODE
1011
1013
RECEIVE SPOKEN PASSCODE
STORE ENCODED PHRASE & PASSCODE
1015
END
1017

Fig. 32

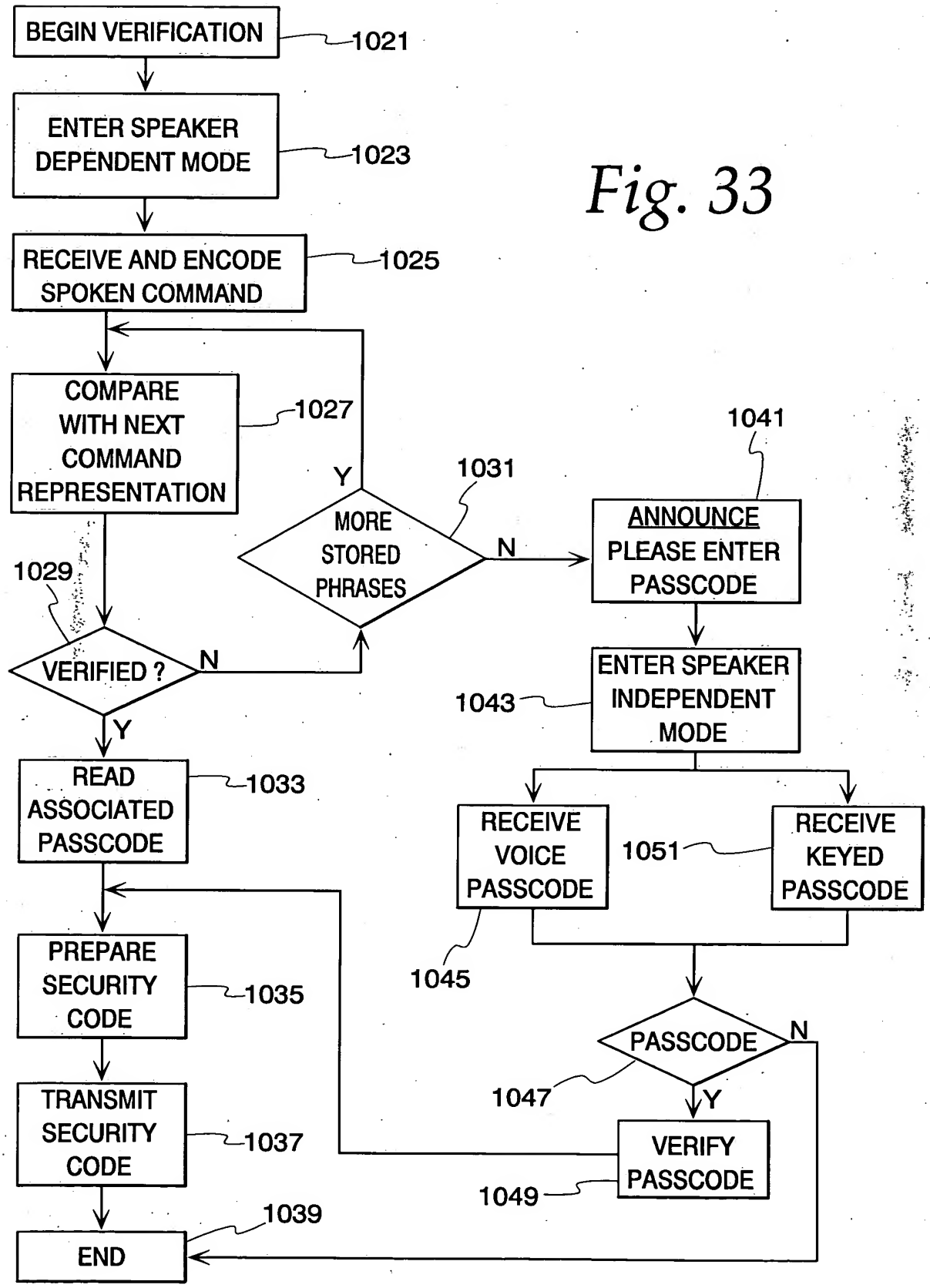

BEGIN VERIFICATION
1021
ENTER SPEAKER DEPENDENT MODE
1023
RECEIVE AND ENCODE SPOKEN COMMAND
1025
COMPARE WITH NEXT COMMAND REPRESENTATION
1027
MORE STORED PHRASES
1031
Y
N
1041
ANNOUNCE PLEASE ENTER PASSCODE
1029
VERIFIED ?
N
Y
ENTER SPEAKER INDEPENDENT MODE
1043
READ ASSOCIATED PASSCODE
1033
RECEIVE VOICE PASSCODE
1051
RECEIVE KEYED PASSCODE
1045
PREPARE SECURITY CODE
1035
PASSCODE
N
1047
Y
TRANSMIT SECURITY CODE
1037
VERIFY PASSCODE
1049
1039
END

Fig. 33

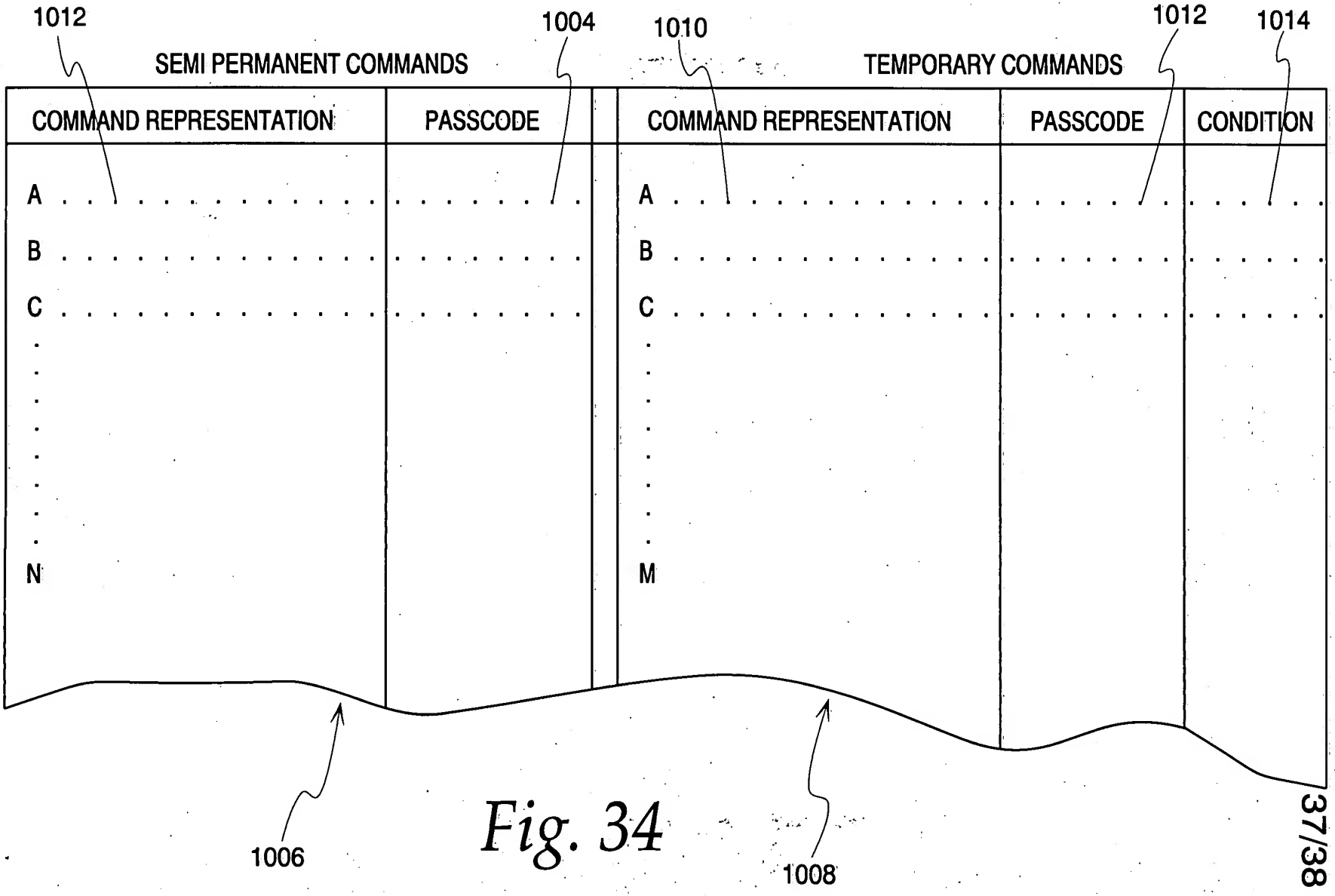

1012
1004
1010
1012
1014
SEMI PERMANENT COMMANDS
TEMPORARY COMMANDS
COMMAND REPRESENTATION
PASSCODE
COMMAND REPRESENTATION
PASSCODE
CONDITION
A
B
C
N
A
B
C
M
1006
1008

Fig. 34

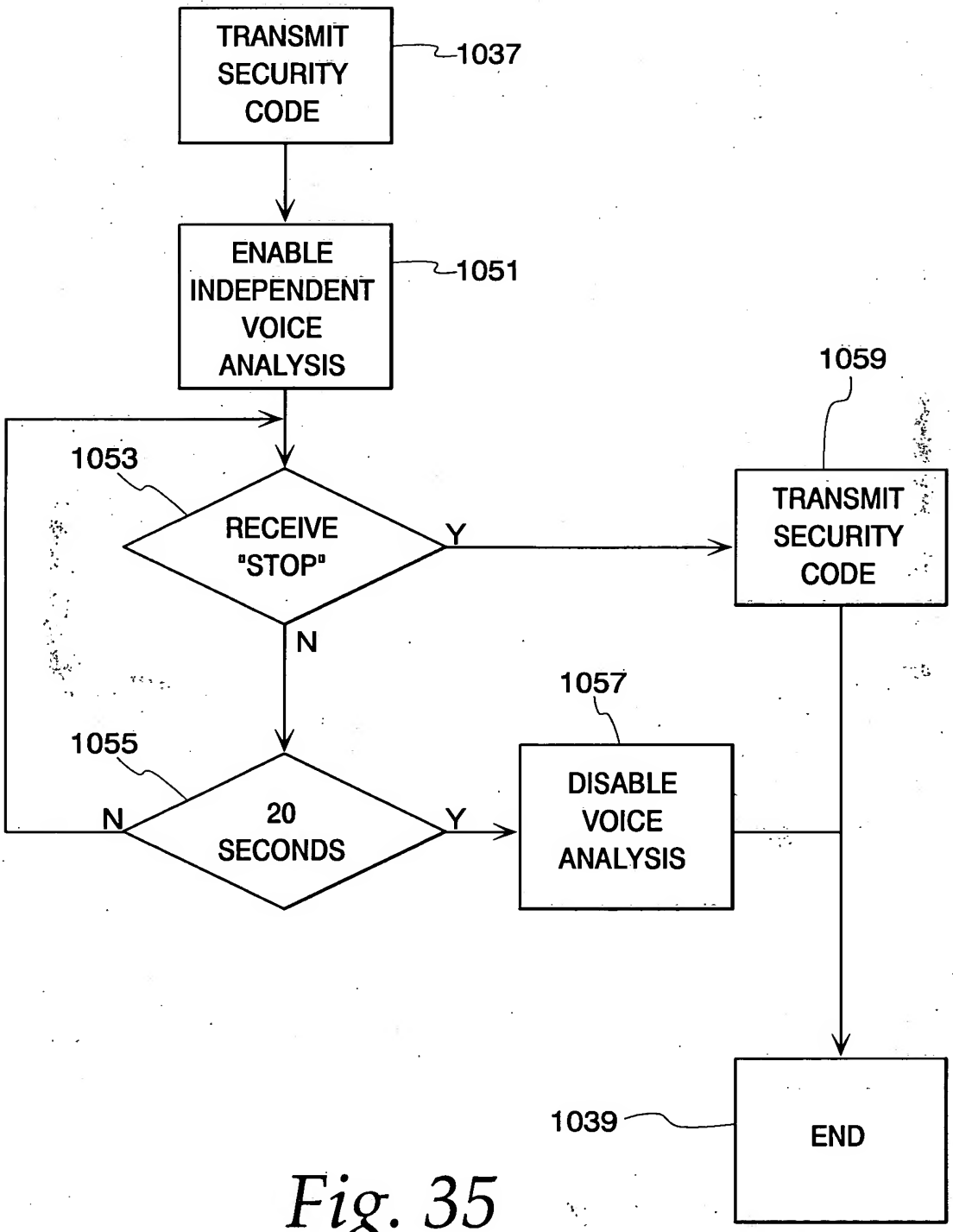

TRANSMIT SECURITY CODE
1037
ENABLE INDEPENDENT VOICE ANALYSIS
1051
1059
1053
RECEIVE "STOP"
Y
TRANSMIT SECURITY CODE
N
1057
1055
N
20 SECONDS
Y
DISABLE VOICE ANALYSIS
1039
END

Fig. 35